WIRED

July/Aug 1995

John Fraser's new generation of breeding buildings.

Finally hands-on: the first interactive TV tests.

Jonathan Waldern: immerse yourself in VR

Bad-boy evolutionist

Richard Dawkins:

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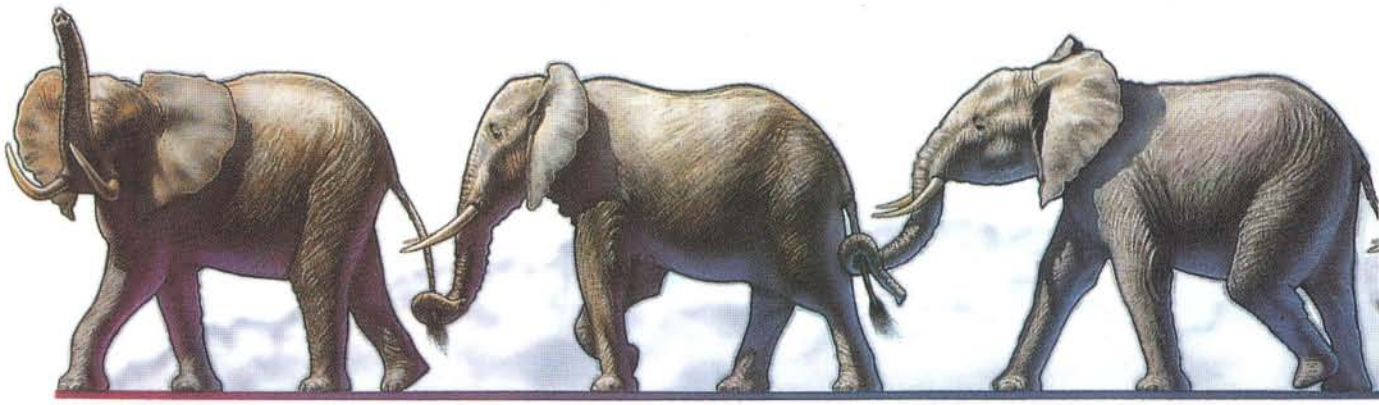

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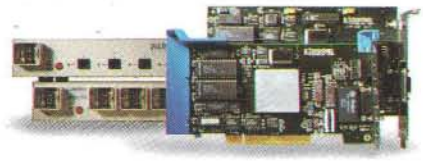

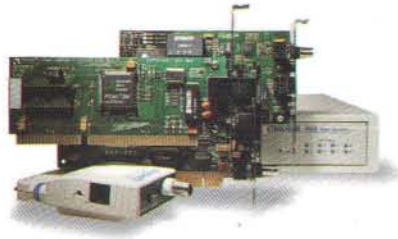

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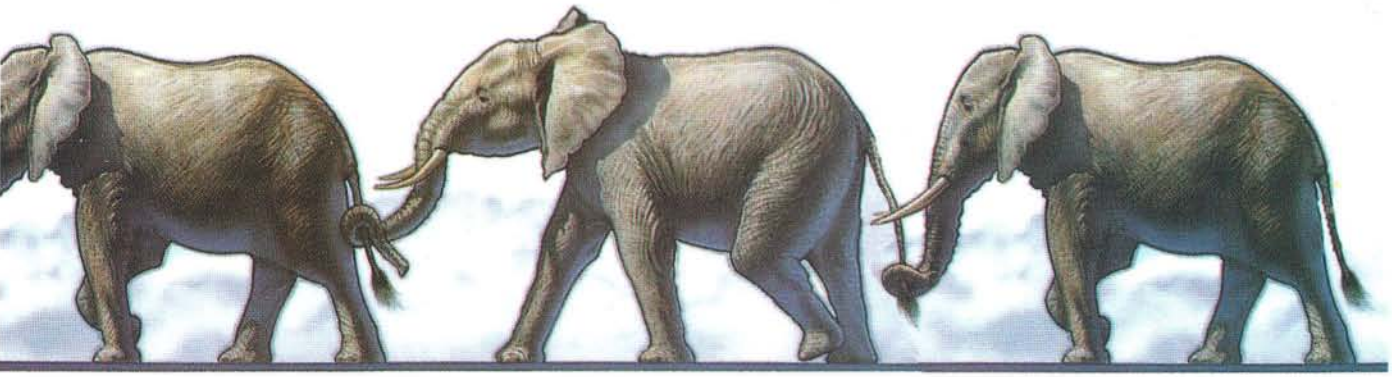

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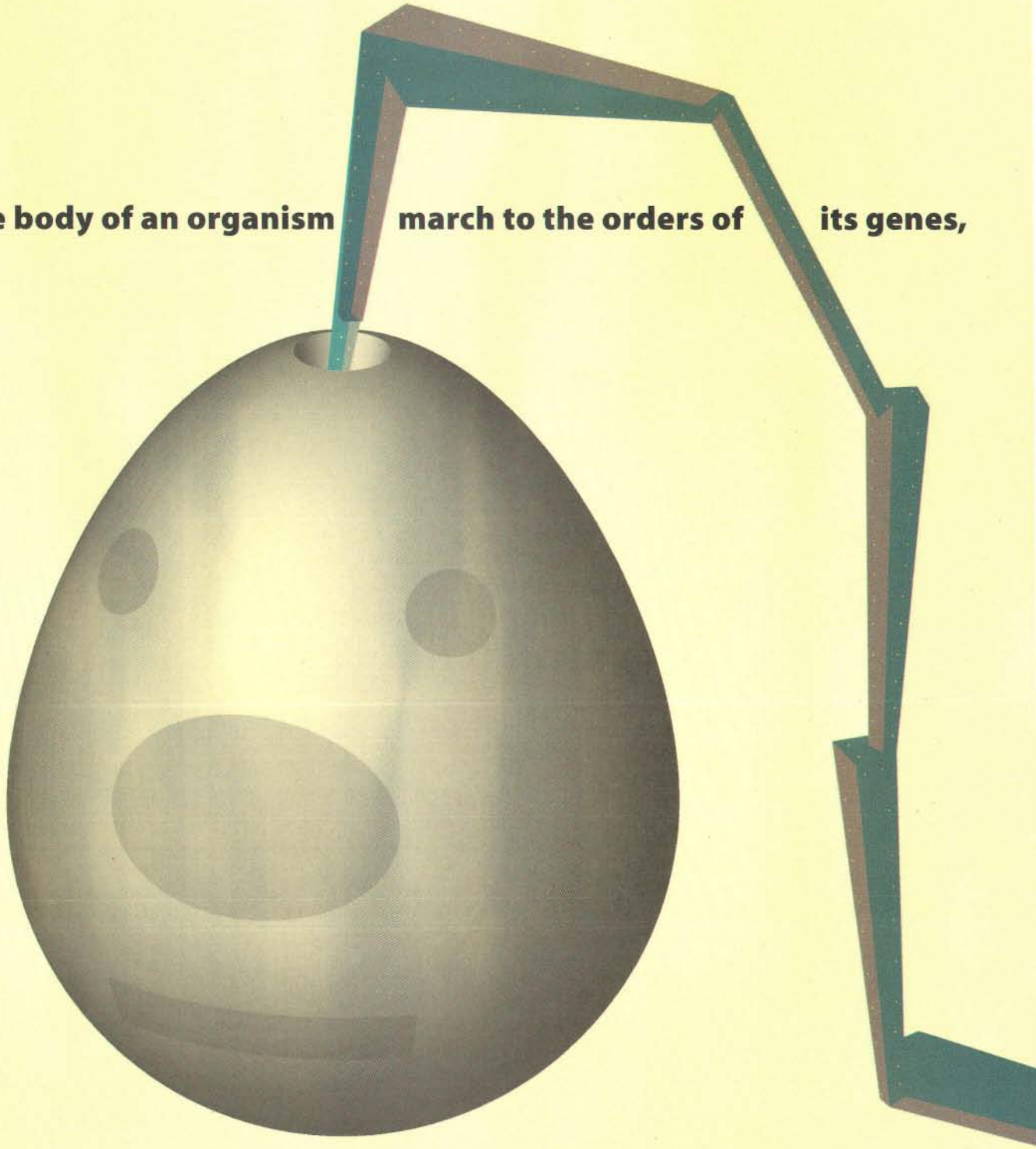
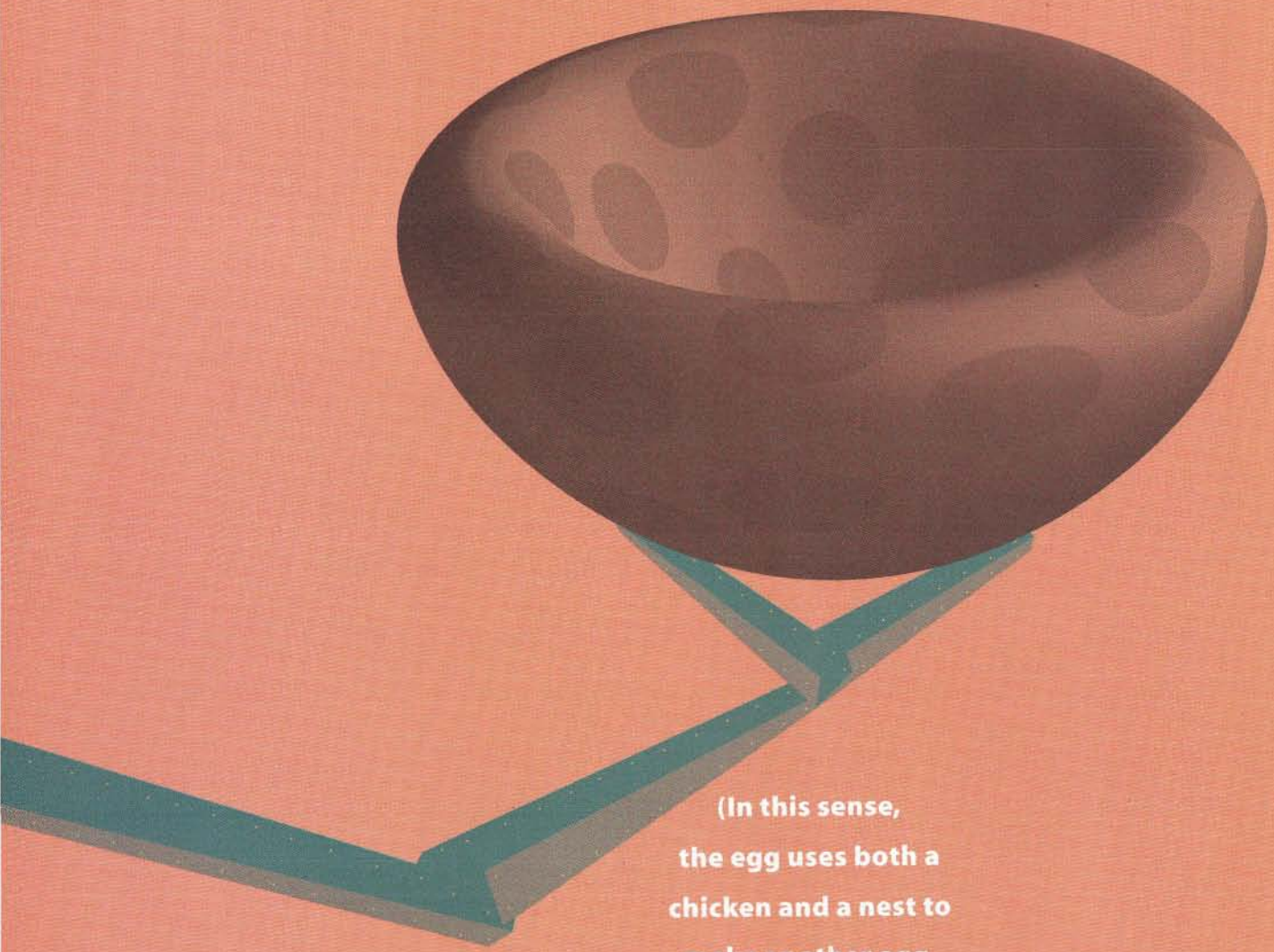
does the body of an organism **march to the orders of** **its genes,**

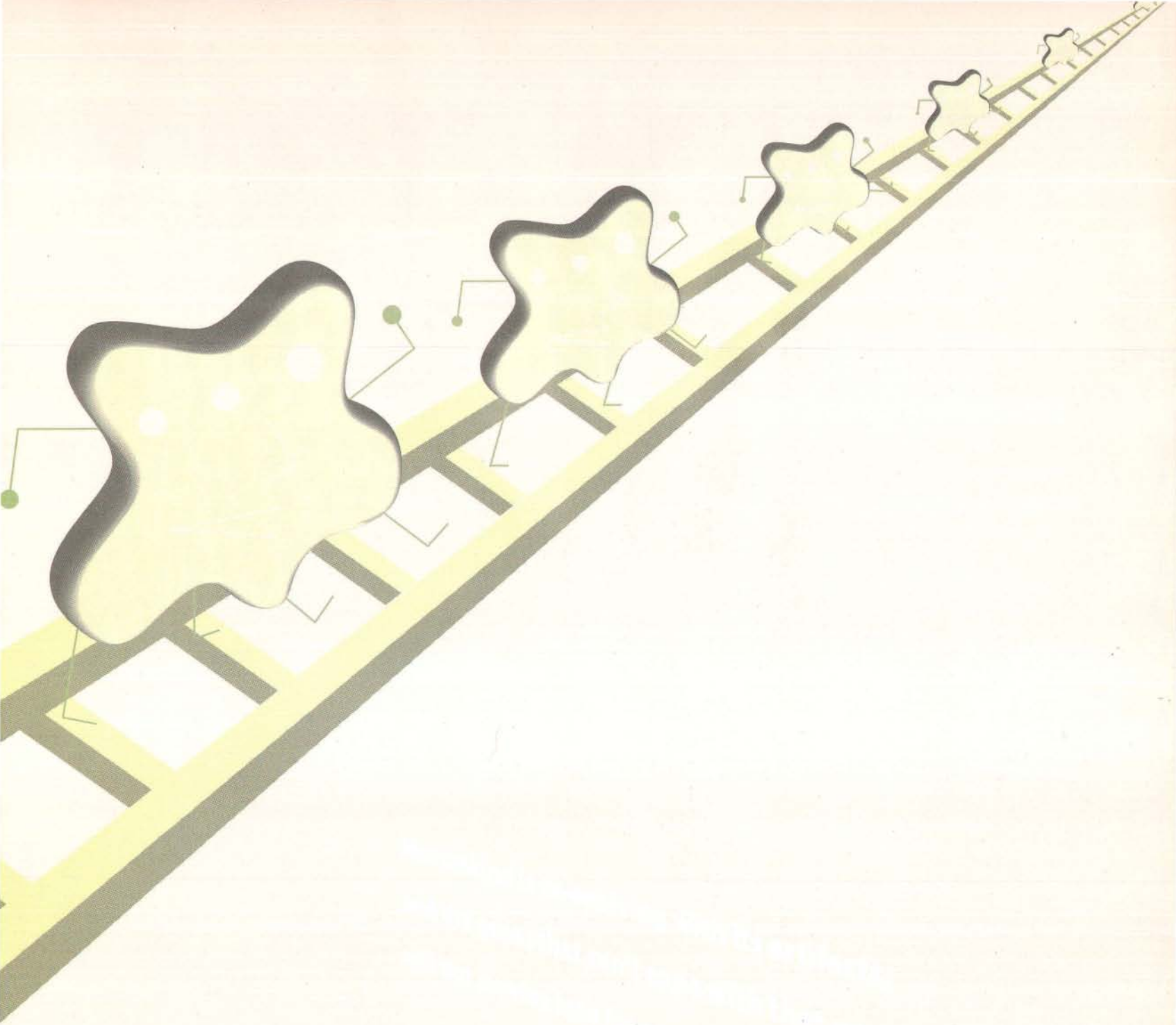


but so do the artifacts the organism builds or uses.



(In this sense,
the egg uses both a
chicken and a nest to
make another egg,
and so the nest, too,
is an evolutionary
extension of the egg.)

Human evolution is now inextricably bound up with technological evolution.



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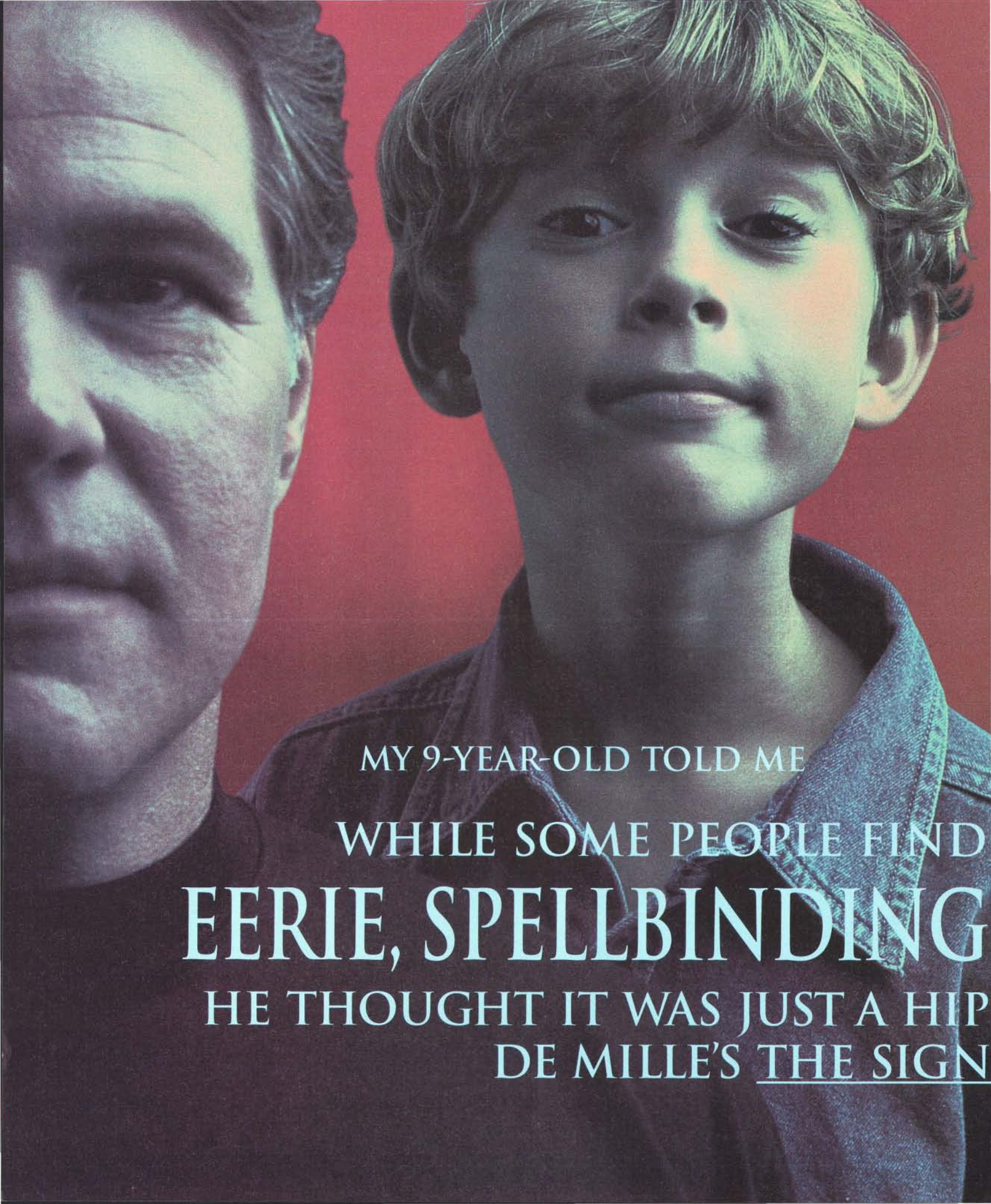
MY 9-YEAR-OLD TOLD ME
WHILE SOME PEOPLE FIND
EERIE, SPELLBINDING
HE THOUGHT IT WAS JUST A HIP
DE MILLE'S THE SIGN

"AND WHEN YOU GET RIGHT DOWN TO IT," my son further noted, "Federico's cautionary images of depravity are no match for Cecil B. 's juicy vision of Nero as a voluptuous connoisseur of agonies."

I promptly asked him who taught him such language? He told me he learned it all from some famous film critic who was now residing in his personal computer thanks to Microsoft® Cinemania® .

He explained this thing was an interactive movie guide with over 20,000 film reviews. It helps him pick out which videos to rent and which ones to stay as far away as possible from. It also had features like video clips from some of the most popular movies of all time, theme songs from 100 movies, 900 movie stills and 4,000 bios of bigwigs in the movies.

Then he asked me if I knew Fellini worked as a crime reporter and a caricature artist before he broke into the film business as a comedy scriptwriter for actor Aldo Fabrizi? "Who doesn't?," I replied as I headed to his room to look for this Cinemania thing.

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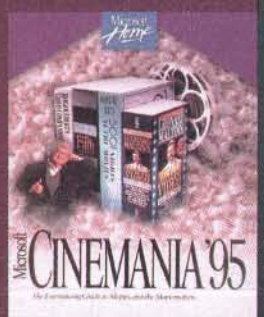

Whatever happened to Peace, Love & Understanding?

WIRED

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"It is the duty of every man, so far as his ability allows, to detect and expose delusion and error."

How to reach *Wired*:
Online:
Editorial: *edit@wired.co.uk*
Advertising: *ads@wired.co.uk*
Other: *info@wired.co.uk*
119 Farringdon Road,
London EC1R 3ER
Tel: +44 (0171) 713 4465
Fax: +44 (0171) 833 2957

Editorial: +44 (0171) 713 4465
Design: +44 (0171) 713 4465
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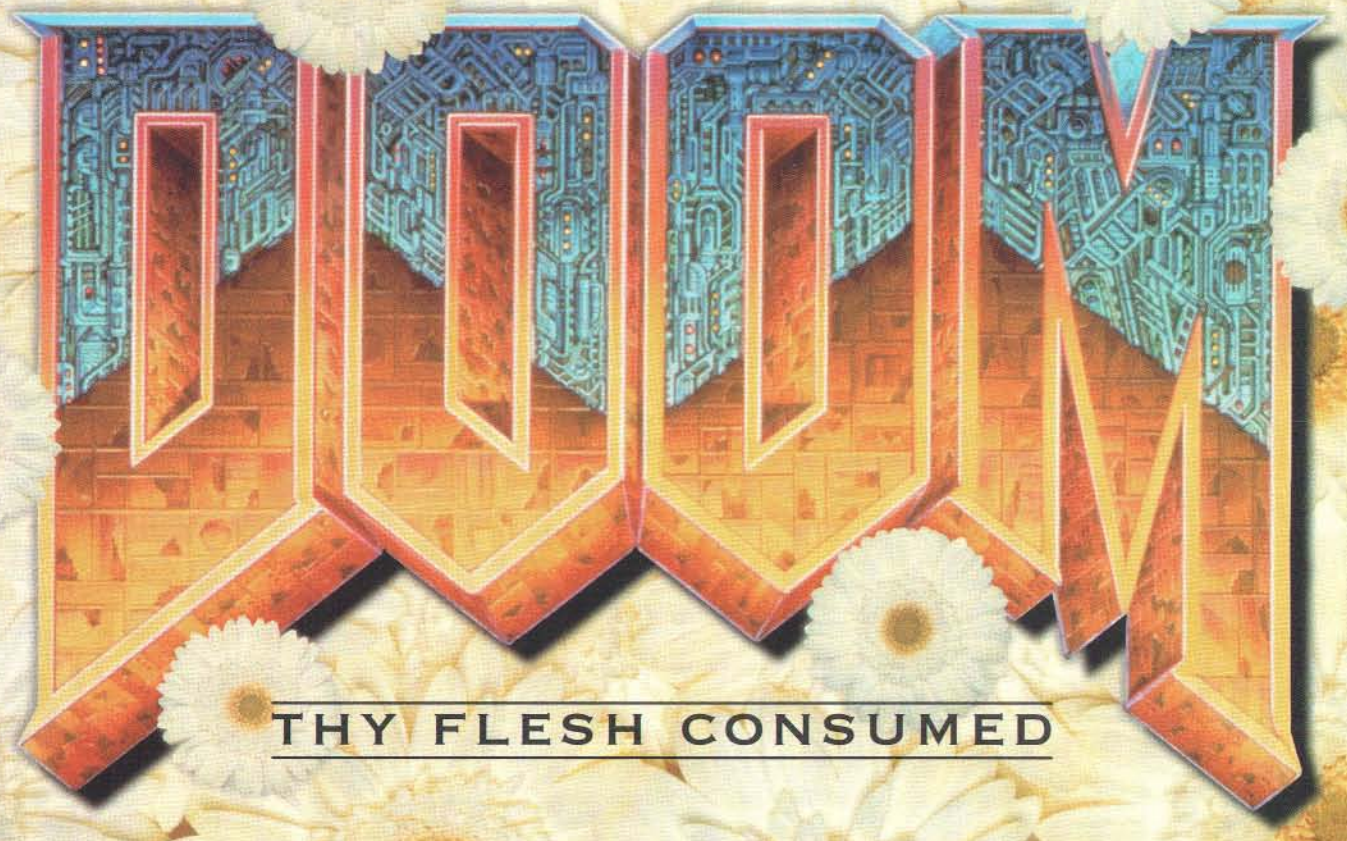

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Editorial guidelines *guidelines@wired.co.uk.*

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Crown caught

In his article about the government's information strategy (*Wired* 1.02), William Heath repeats the myth that the CCTA GIS server was "hacked" within minutes of going online. May I correct this before it is too firmly embedded in Internet mythology?

In June 1994, CCTA issued a consultative report on "Information Superhighways – Opportunities for public sector applications in the UK". We placed a copy of the report in the public domain on the Demon ftp server. This report was in plain ASCII text.

An enterprising young student at Lancaster University (Zack Evans) took a copy of this plain text file, converted it to HTML format and re-published it on his own server (*http://cent1.lancs.ac.uk:8080/zack/govt/report.html*).

Quite properly, he acknowledged Crown copyright (and we think he did a good job on the report).

Our Minister saw a copy of this report and drew an unfortunate conclusion. In an off-the-cuff remark in public he said that "CCTA had been hacked in minutes". This remark was picked up and published in an article in the *Guardian* on 8 December 1994.

As you will be aware, any document placed on an anonymous ftp server is freely available to anyone with an Internet connection. The fact that a copy is now available on another server is not in the least surprising. Thus, at no time did anyone "hack" into the open government server.

Nic Hopkins
nhopkins@mail.ccta.gov.uk

Use the source, Luke

As regards the snappy little article entitled "Caught – the Net Generation" (*Wired* 1.01), which tells the story of an incident in the computer room here in Cambridge and a silly comment made by a *Star Wars* fan on a local newsgroup, all unaware he was going to be quoted without attribution – first in the University newspaper and then in the national media…

That's me.

David "Gotterdammerung" Damerell
djsd100@hermes.cam.ac.uk.

Blighty blighted

Somebody @ *Wired* blew it. You had the chance to establish yourselves as *the* global magazine, in the global market, writing about the global impact of electronics and the Internet. Yet you foist an anorexic imitation on the UK market – shortly to be followed, no doubt, by a garlic-flavoured French version, a German edition rolled to resemble a frankfurter and maybe, for all I know, an Italian magazine called *Spaghetti*. Go mend your fuse and get switched on.

That that is, is. – WS, *Twelfth Night*.

Malcolm McClure
malcolm@mcclure.demon.co.uk

A fine romance

Hey, just what is all the fuss about? I mean, all this rabid whining and bleating; all the wasted time and energy given over to denounce the content and, if we're to believe N P Walkley (*Wired* 1.03) heretical editorial policy of the British incarnation of *Wired*. Is it necessary or warranted? No.

Look, how anyone could possibly think that a British-inspired *Wired* could ever be a carbon-copy of its American parent is beyond me! No, on the contrary, this metamorphosis is a British *Wired* for a British readership or if you must, a European readership.

So, for all those vitriolic disbelievers out there, who for reasons best known to themselves cannot abide what they apparently perceive as a creeping contamination of what was once an American publication only, may I offer them the following suggestion: do as I do and subscribe to the American version too! That way, not only will they be able to sleep at night but, the more enlightened amongst us can, via the power of purchase and intelligent comment, help to ensure that our indigenous *Wired* reflects what the British reader thinks rather than what the American reader thinks! It might even end up being better.

Ray J Howes
Weymouth, Dorset

Look who's talking

Thanks for an excellent magazine – at last, a publication that provokes a bit of thought and discussion. The article about Peak Interactive (*Wired* 1.02) did just that. Founder Janet Darwin, like friends of mine, "can envisage a situation, perhaps as little as six months away, where the client hires the company's skills over the wires."

I work as a marketing consultant for a two-man company. Whilst I would love to look out over green fields every day, living in London is essential for me.

Working in an idyllic location such as the Peak District has its benefits of course, but Peak Interactive could find themselves missing out on a key marketing opportunity: socialising.

No number of e-mail messages can make up for a bit of face-to-face social interaction. It may cost £15 billion a year just to get people to work, but that figure is easily balanced by the synergies of people talking directly to each other.

In fact, I hope that technological advances will allow me to use my time more efficiently – so that I can spend more time sitting in West End restaurants and wandering around trade shows at Olympia.

Guy Mattinson
London SW15

Busy rock icon, not Sting? (5,3)

Welcome to the world of dead trees! When I heard that *Wired* was coming to the UK, I had my doubts – most of them in line with the sentiments expressed by Michael Bywater (*Wired* 1.02).

How can you make the UK high-tech scene attractive? Sure, we've got plenty of developments going on in this country, but no-one wants to know about success stories in Britain.

However, your contents were fine: a good failure, some winner brought up short – now you're talking!

I thoroughly enjoyed the article on CCTV, likewise the *Duckman* piece was good enough to get me downloading sound files of Cornfed. Nice to see, too, that you're following nature with your front covers. Insects use yellow and black to scare away enemies, but you guys go one step further and add a photo of Brian Eno! Keep it up, but please, drop the rock icons. Unless they're compatible with System 7.5…

David Rider
Rider@CityScape.co.uk

Significant other

Hello. I've been reading the UK *Wired*, and I must say it's staggeringly good. I like the way it's convinced of its own immense significance.

Tim Tucker
ttucker@futurenet.co.uk

Undo

Royal College of Art student Mark Weber (*Wired* 1.03) does not, in fact, spell his name "Mark Webber".

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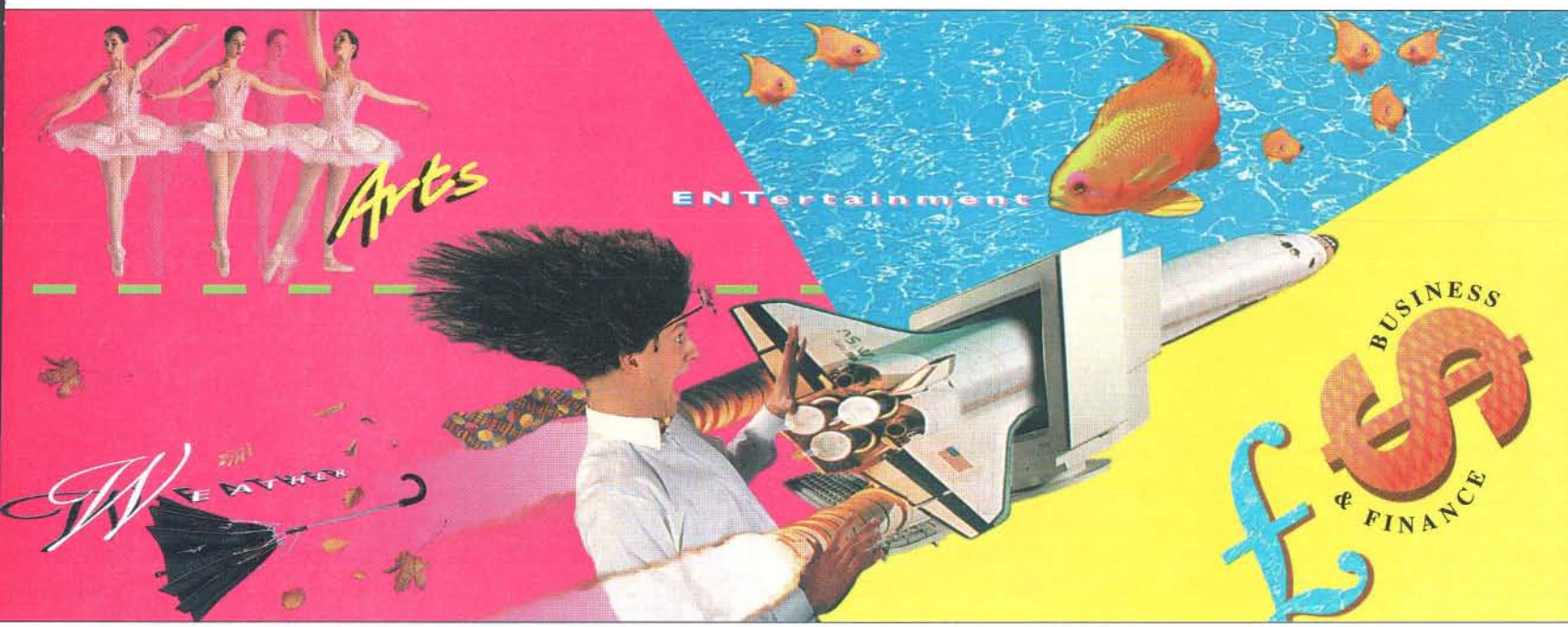

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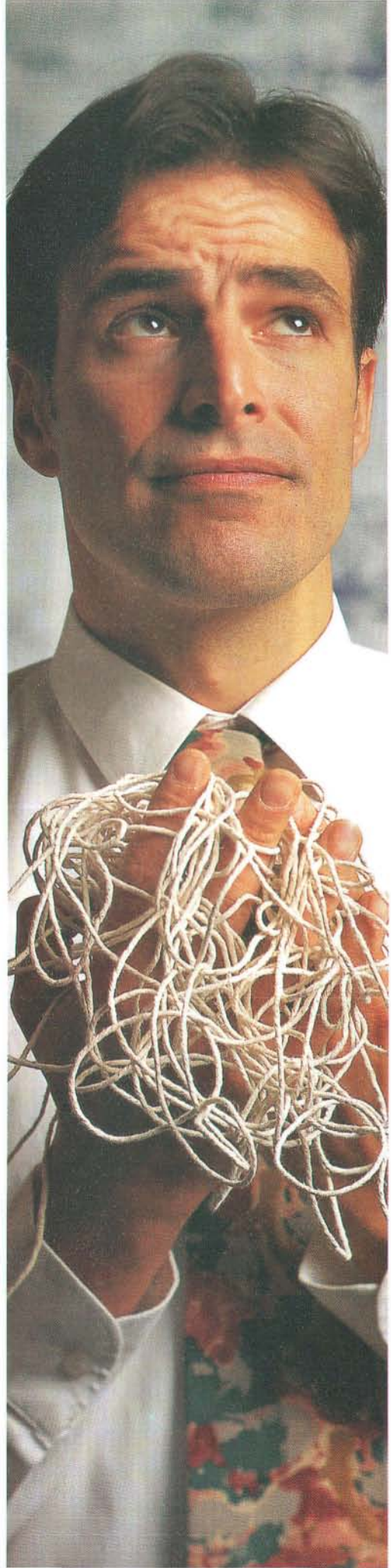

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Virtual Verité

"This disk is guaranteed to offend everybody," says Judah Passow, award-winning photo-journalist turned multimedia author. His CD-ROM "Days of Rage: Beirut 1982-1985" combines his powerful black-and-white photographs with the spoken words of participants in the conflict. The commentary comes from the point of view of the people in the photographs. "These are the little people in the war," says Passow. "People who have never been asked what they thought. The people in whose names these wars are waged. The people who get lost in the smoke and the fire and the haze. Here they are speaking candidly as individuals who have had enough."

The disk is the first in a series revealing Passow's take on major current affairs issues including the conflicts in the Middle East and the former Yugoslavia. "What I'm doing is delivering the message from this Lebanese woman, from that Israeli soldier," Plassow says. "This is them, with no censorship." Days of Rage £49.95. Multimedia Solutions: +44 (01132) 342 528. – *Tom Standage*

E L E C T R I C W O R D

≡III Cross Media?: The new media-ownership rules introduced by Stephen Dorrell answer some questions, but hell, they're not going to create any new Viacoms, are they? Doesn't anyone want UK media to compete? ≡III Rupert Says: "I don't pretend to understand all that's going on in technology. I know that incredible possibilities are opening up and I believe that people basically want free broadcasting, they want a good programme. If it's something very special then maybe they'll pay ►

SIMON MARSH

Milking the Net

Launched in 1970 on a wave of revolutionary euphoria, Italian radical publisher Stampa Alternativa is not new to attention-grabbing promotions. Its head yippie, Marcello Baraghini, staked everything on a range of "millelire" books – a mixture of paperback debuts and literary classics – sold at the price of a newspaper. After a year or so of giddying success, the competition moved in and Baraghini turned to inventive packaging. Stampa Alternativa's literary 10-packs soon became collectors' items – especially the one based on the Marlboro packet.

For its first foray into cyberspace, Stampa Alternativa has ditched the nicotine connection in favour of a more wholesome image: milk. "The message is: try the Internet – it's healthy, natural and filling," comments PR man Marco Ferrazzoli. Inside a carton bearing the logo of Italy's leading dairy producer, Parmalat, Stampa Alternativa have crammed the Internet Collection: nine manuals and a floppy disk containing communication packages.

The software can be set up to communicate directly with Agorà, one of Italy's leading Internet providers, which itself has a colourful political past. Set up by the Italian Radical Party as a cosy in-house network, it went commercial a few years ago. Agorà is big on Internet democracy, offering free access to its range of services: e-mail, bulletin boards and gateways to the lower house of the Italian parliament, the databank of *Il Sole 24 Ore*, a financial daily, and the main national libraries. Access costs about £80 – cheaper than the state monopoly, Telecom Italia, can manage.

Agorà boss Roberto Cicciomessere says TI is "the main obstacle to the construction of an Information Superhighway in this country." – *Lee Marshall*

Walls Come Tumbling Down

Revolutionaries have long wanted to tear down the walls of government. Now architects do too. The Design Council, sponsored by Thorn Lighting, recently held a competition to redesign the Houses of Parliament.

The winner, Tobias Lee of the Ravensbourne College of Design and Communication, proposed doing away with buildings altogether, replacing Victorian Gothic with a virtual government, floating in cyberspace.

Whatever they may do for politicians' sense of self-importance, walls and spires get in the way of democracy. More people could participate in the debates of a virtual government – the visitor's gallery would be virtually infinite. A virtual Parliament would fit itself to the size of the debate – no longer would the chamber be overcrowded for important votes and nearly empty on other days, with a few MPs huddling in the line of sight of the TV cameras. More information could be brought to the debate. Instead of answering questions about road traffic with a few dry statistics, ministers might invite the opposition to an interactive simulation of motorways.

A second virtual Parliament, by Alex Maclean of the Royal College of Art, also reached the short list of 12 (see illustration). While it didn't win, MacLean did get sponsorship from the Public Interest Research Centre. He will spend the next few months devising ways for computers to help people find their way around government – creating democracy from bureaucracy. Buildings can't do that. – *John Browning*

FACING PAGE: STEVE DOUBLE

► a price for it, or maybe they'll pay a premium... But free, over-the-air, advertising-supported broadcasting, which goes universally to people will remain absolutely the predominant force in this. That's where the money's going to come from, that's how the programmes are going to be made." Murdoch's interview at the recent NAB. ≡III Citizen Net: The name William Randolph Hearst usually conjures up, well, allegedly Melud, Orson Welles's classic film, *Citizen Kane*. Now another WRH (the third) is to head up a new Silicon Valley venture that could be every bit as powerful as the print Hearst group. @Home brings together TCI Technology Ventures and West Coast venture capital company, KPCB. Their aim: to offer high-speed Internet access via cable television – potentially a much faster way than via conventional telephone wires. ≡III Barely Rising: Japan is lagging behind in the Net stakes with just 72,400 connections ►

The Hitchhiker's Guide to the Gallery

The Gallery Guide is a portable CD-ROM player that gets around the problem of wandering through art galleries while listening to a headphone-based audio commentary. You just type in the code number of any painting in the building, and you'll hear details of how, when and where that particular masterpiece came about.

The device is the brainchild of Arts, Communication and Technology – a UK company employing just half-a-dozen people, previously known for devising the world's first talking translator units. Compressing up to 40 hours of randomly accessible audio onto a single CD, the Guide lets you examine the exhibits you want, in the order you prefer, for as long as you like. The system debuts at London's National Gallery in late June. It allows gallery owners to upload data on the most-accessed audio commentaries while the units are being recharged.

Best of all, the equipment resembles Mr Spock's classic *Trek* Tricorder, so there's potential for standing in front of the nation's best-loved Old Masters, "scanning" them with your Gallery Guide console, listening to the voice of the expert, then musing: "Hmm – fascinating." – *Dave Green*

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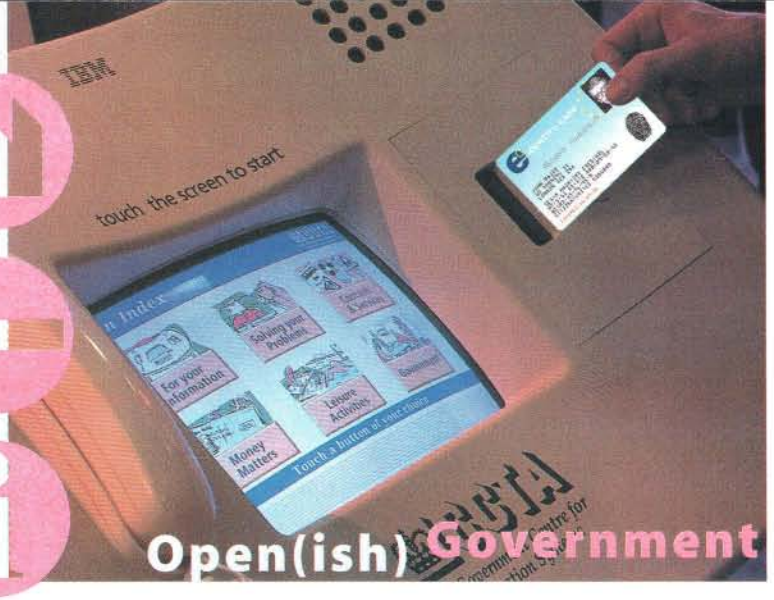
You've just turned 40 and hit that mid-life crisis. You're bored. You once astonished a company called Amiga by making their hardware work for the very first time. But that was 10 years ago and the Amiga's been and gone. And your operating system made that wacky UK parallel processor, the Transputer, sing in chorus, until mismarketing buried the whole idea. That's life, Tim King.

So you talk to your friend and mentor, Hermann Hauser, who is besotted with Home Shopping. You're not so sure... "Home shopping is a long way off, but online services are much, much more than just shopping," says Tim King, MD of UK Online, which launches in August. "We plan to give everybody in the country local call access by the end of the year," King says.

And it's truly British ? "Yes, we're battered by American culture via TV... The whole point about UK Online is that it's for the UK. Football means a round ball, television means BBC or ITV and when you buy something it's six quid, not eight dollars. Moving onto the Internet you have a cultural base to kick off from." So, still bored? "Nope. You?" *– Chris Bidmead*

40 is a Dangerous Age, Timothy



Open(ish) Government

The CCTA, the agency responsible for the government's use of computers, has launched a prototype public-access multimedia information kiosk. Developed with IBM, the smart "community access terminal" allows access to a plethora of useful information – including the Internet.

Unlike existing public terminals, the "CAT" kiosk hosts information created by several authorities: from the teletext-based community information service in Oxfordshire to the graphical tourist information in Calderdale. Newer services make full use of the multimedia facilities, most impressively an easy-to-use benefits information (and eventually payments) service – which operates in a number of languages to accommodate users whose first language is not English. For benefits, users will always need to swipe a smart card through the machine. Effectively, this restricts the availability of certain information – an essential feature. – *Azeem Azhar*

TIRED

- Prophets
- Information Superhighway
- NII
- Swindon
- Penile augmentation
- Media ownership rules
- Pyramid schemers
- Megastore in-store listening
- Talking books
- Answering machines
- Gak
- Damien Hirst
- Serial killers
- Hot Java
- The National Lottery
- Postmodern

WIRED

- Profits
- vBNS Supercomputer Net
- GII
- Warwickshire
- Calf implants
- Murdoch ownership rules
- Viatical settlement brokers
- IUMA at-home listening
- Dillons Cyber.St@tion
- Call Minder
- Floam
- Keith Tyson
- Massively parallel killers
- Aretha
- The National Gallery
- Postconsumer

► (40th place, globally, in a ranking which correlates GNP with Net use) and risks losing key domestic-service industries. What's the lesson for Europe? According to the *Financial Times*, which quoted Kenichi Omae, former chairman of McKinsey in Japan, the country is too bureaucratic. "The emergence of a globally networked society means ... service industries are moving away from countries with rigid regulations to those with more flexible, multimedia-friendly law systems," he warned. Thank goodness we don't have that problem, eh? ≡ Pardon?: British libel law currently makes the distinction between libel – when the defamation is in some kind of permanent form (damage to reputation doesn't

His Master's Voices

Roger Doyle's *The Babel Project* is a sprawling, ever-growing CD collection of electro-acoustic compositions, each representing a space in an imaginary Tower of Babel. Already completed are pieces for the stairwell, temple, mansard and garden room. (There's also a radio station, KBBL which promises "Information and entertainment. In a language of your choice.") "I really wanted to make a virtue of all the different musical styles I use," says Doyle.

Whether constructing virtual performances from dozens of edits or exploring the outer reaches of SoundTools, Doyle explores the labyrinthine possibilities of computer music with relish. *The Babel Project* has incorporated over 30 collaborators: architects, writers and designers, as well as musicians and disc jockeys. It manages to combine monolithic slabs of multi-layered electronics, ear-wrenching verbal cut-ups, delicate solo performances from six different virtuosi, sweet ballads and cheesy pop. Doyle now has over five hours of finished music. The latest available instalment is the CD *Temple Music/Earth To Earth*, which has been added to the re-release of the 1981 debut album by Doyle's Operating Theatre. – *John L Walters (walters@gn.apc.org)*

Berlin Bytes

Few cities conjure up as many memorable images as Berlin. But today, the new capital of a reunified Germany is, visually at least, a boring building site waiting for history (and property developers) to re-invent it. So, because the reality is rubble, builders are turning virtual to attract attention.

The buzzwords for this are "architectural animation". The double magic of film-animation software and architectural know-how is showing how empty spaces might fill up with the signs of modern life: tinted glass, reinforced concrete, The Gap and McDonalds.

"Architects' 2-D CAD drawings are so complicated, nobody can understand what things look like," says Adrian Johnson, a partner in Archimation, one of a handful of architectural animators starting up in Berlin. "Our stuff is the real thing." And the market for these alternative realities is booming. Archimation's three-man operation is working on 70 projects around town.

That can't be said for the property developers. Since the euphoria of reunification evaporated and it became clear Germany's government would not be in Berlin until at least 2000, outside interest has waned – and real-estate prices have halved. On the eve of the sales pitch, desperate developers looking for any edge contact Archimation to create custom images of how a potential client's business might fit into a still-to-be-completed retail space.

There's one snag. The virtual buildings are based on real plans – and, despite Berlin's high profile, many of the architects working on the city's revamp seem to have checked their imaginations in at the door. The array of boring blocks that are slowly emerging out of the rubble is astounding. The shining new Lehrter Bahnhof, as imagined by Archimation, is a welcome exception. – *Deborah Wise*

RONALD SHERIDAN/ANCIENT ART & ARCHITECTURE COLLECTION

have to be proven) – and verbal defamation (where damage does have to be). And, yep, as electronic correspondence can be stored or printed out, it is now deemed, or, at least agreed as, permanent. So, as we have pretty repressive libel laws, it's going to get flaming heated. Hold onto your British mouse mats, it's going to be a bumpy ride. ≡III Pardon? 2: Microsoft is testing an anti-software-pirating initiative in England called LegalWare. Wonder why? It consists of software and hardcopy that tries to explain the implications of software piracy. ≡III Channel Wired: Tired of the old spotty-lads-on-the-Net stuff? On June 27, Channel 4 is broadcasting a programme about, hey, women on the Net. Contributors include the Technowhores, a seventysomething former Wren who ►

JARGON WATCH

E-Proxy
A person who is left behind in the old country when his or her friends have joined the graduate diaspora overseas, but is contactable via e-mail. The friends, therefore, have a cheap and fast means to get him or her to handle cheques, sort out parent crises and act as an unpaid agent or proxy in the mother country.

Batmobiling
Putting up an emotional shield just as a relationship enters that intimate, vulnerable stage. (From the retractable armour covering the Batmobile.)

Faxploitation
The growth of rip-off "fax-u-back" information services to replace the income that chat-line entrepreneurs lost in the clampdown on 0898 numbers. Alternatively, the high cost of sending a fax from a corner shop or reprographics shop. "One pound fifty for a single page? That's FAXPLOITATION!"

Triple-Dub
The abbreviated way to say "WWW" ("double-yew, double-yew, double-yew") when naming a URL. Thus: "hey, check out this cool Web site at triple-dub dot neowobbly dot com."

HTML3 Positive
Describes Web pages that support HTML3 – arguably a virus propagated by the authors of Netscape to ensure world supremacy for their browser software. As in, "this site is HTML3 positive, I'm afraid." Or, "another site just went HTML3 positive, folks."

Value-Subtracted Reseller
A company that buys components from other companies and puts them together to make a system that's worth less than the sum of its parts. The opposite of "value-added reseller".

Cyber Noir
Used to describe dark, trippy, weird "cyber" TV and games like *Wild Palms*, *Burn:Cycle*, and *The X Files*.

In the Plastic Closet
Said about someone who refuses to admit to having had cosmetic surgery. "Is Tori Spelling in the plastic closet, or what!?"

Waitbuster
Supermarket checkout displays that entice you to buy, buy, buy while you wait. (Also called a "shelftalker".)

Macintosh 89
Disparaging way to refer to Windows 95, implying that PC users are at last being promised the same sort of easy-to-use desktop interface that Mac owners have been enjoying for at least the last six years. Best used by way of direct comparison: "Windows 95? Macintosh *89*, more like!"

Tug o' the forelock to: Jerry Dunn, Gavin Ivester, Kevin Kelly, Mikki Halpin, Michael Gold, Jef Poskanzer, Marjorie Ingall, Tom Standage, Nigel Burke, Dave Green and Michael Prochak.

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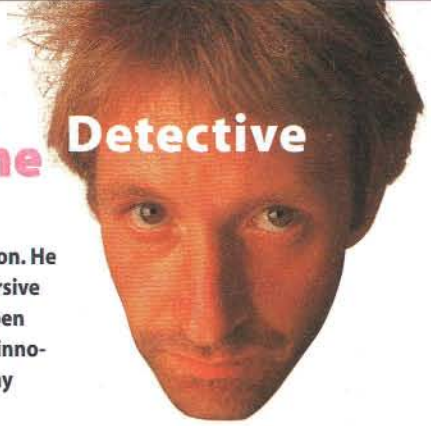
Watching the Detective



Peter Warren is a man with a mission. He believes that extreme and subversive material should be taken from the open access I-way and hidden away from "innocent or impressionable people" by any means neccessary.

His crusade began back in March with an article in the trade journal *Computing* titled "Anarchism runs riot on the superhighway". This and a subsequent article associated one of the co-editors of anarchist Internet archive Spunk Press *(http://www.cwi.nl/cwi/people/Jack.Jansen/spunk/Spunk_Home.html)* with various terrorist activities, including distributing recipes for incendiary devices to schoolchildren. The individual concerned has now lost his job and Net access.

Warren's reasoning is simple: "If I was in the pub, and I said 'I'm going to kill the Pope and I've got a bomb recipe to do it', then I'd expect to be arrested," he says. "The Internet is another public space, and people should be made aware of their responsibilities in that space."

He has now extended this logic into the online worlds of anonymous mailers, copyrights and Pretty Good Privacy. A flood of criticism from *Computing* readers has not put him off: "If [the editor] had thought about what he was doing he would not have lost his job." And he has vowed to keep on writing articles... — *James Bloom*

WIRED TOP 10

The top 10 ranking British investors in Information Technology

	Company	Annual spending on IT
1	British Telecom	£580 million
2	GEC	£388 million
3	British Gas	£313 million
4	Reuters	£199 million
5	Great Universal Stores	£187 million
6	Post Office	£186 million
7	Shell	£175 million
8	BR board	£160 million
9	Thorn EMI	£156 million
10	Rolls-Royce	£151 million

Source: Corporate IT Strategy/Spikes Cavell. *Fact:* Hanson spent 0.1 per cent of its £9.7 billion turnover on IT. The average IT investment was 1.58 of turnover; in the US this figure is 2.9 per cent.

► worked on the first computers during WW2, a women's aid worker from Yugoslavia and a women's darts team from Hackney. There's going to be a Net chat after the show, together with IRC links. ≡III Evolving Museums: The Natural History Museum is about to evolve. Its new interactive video and computer installation, on the theme of evolution, launches on June 30. Created by artist Simon Robertson and photographer Sinclair Stammers, it is threatened to be "one of the largest and most ambitious electronic-art projects in the UK." We're also promised an interactive romp through Darwinian natural selection to AI. ≡III Code or the Grecian Urn: David Gelerntner is the Yale University computer

Spy vs Spy

If you were Q and spent your days designing killer gadgets for James Bond, where would you go to score cool kit? How about the Covert Operations Procurement Exhibition? COPEX really exists. So does Q. His name is Nick Finlayson, and he's responsible for 007's armoury in the upcoming Bond movie, Goldeneye.

He attended COPEX to check current espionage trends. "I got talking to a guy who designs boats for the SBS, the marine equivalent of the SAS," recalls Finlayson. "He showed me an ultra-light boat with holes in the hull to let divers slip underwater. He said, 'if you think this is good, it's five years behind the real secret service stuff.'"

So what's he given 007? The usual exploding pen-and-laser watch, plus a weapon-heavy wheelchair "with off-road capability" and a snazzy piton gun. Finlayson originally wanted the piton launcher as a clip-on addition to Bond's classic Walther PPK but was overruled. The design is now based on a CO_2 paintball gun, with three Blake's Seven-style prongs added to the flechette. "In the past," he explains, "Bond could transcend what people knew about... Now it's a problem just to keep up."
– *Robert Leedham*

FINLAYSON: STEVE DOUBLE; WARREN: SIMON MARSH; FACING PAGE: RICHARD DEAN

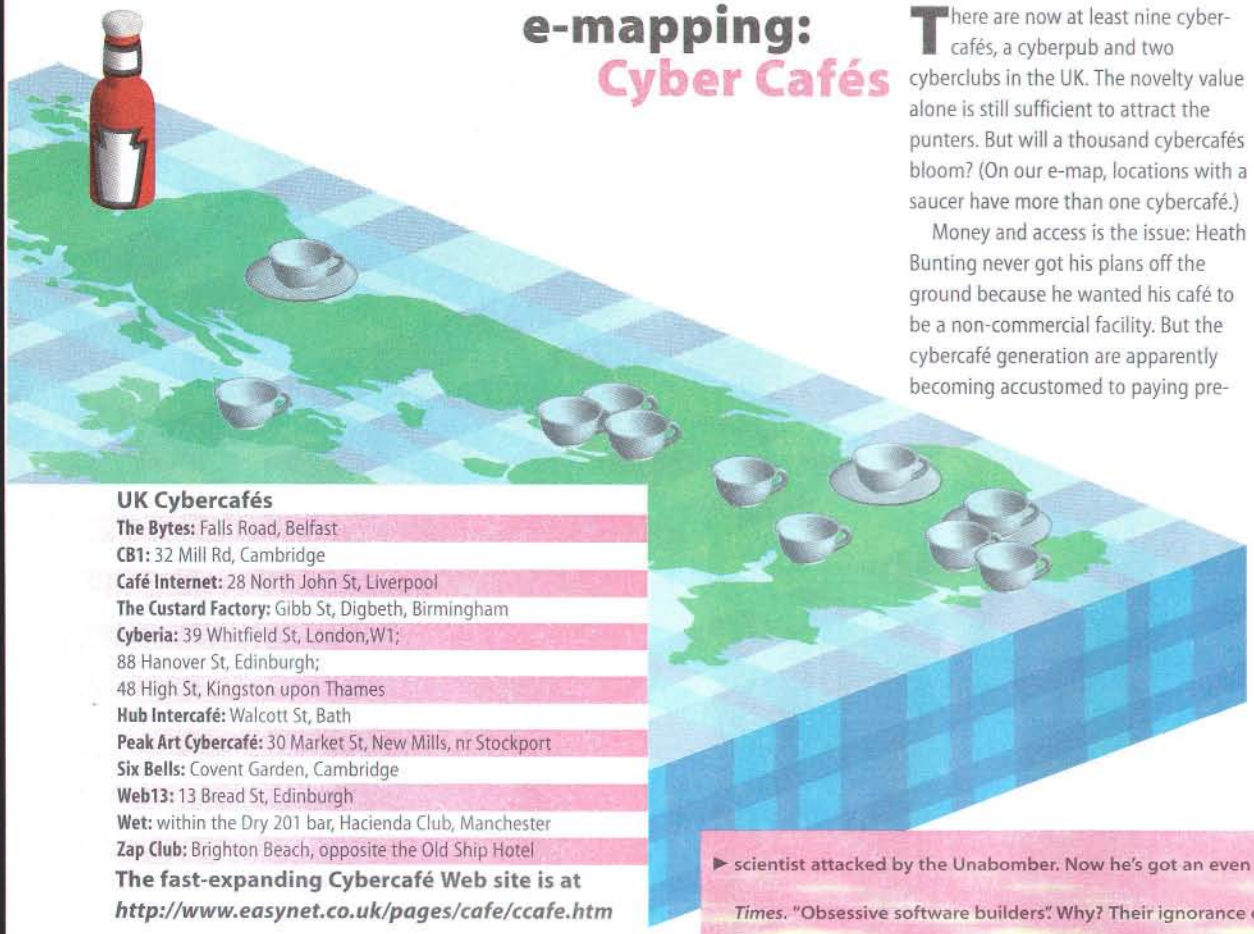
Unhidden Persuader

The Net can make *anyone* famous. So these days, an audience with the brand known as Michael Strangelove is not an easy thing to arrange. The Canadian guru of Internet advertising arrives to be interviewed with a four-strong BBC camera crew in tow, and proceeds to interview *Wired* (for his second book), offer a feature idea, and to declaim to everyone around about religion, gender and alternative lifestyles.

Strangelove is the editor and publisher of *The Internet Business Journal*, a 20-page monthly magazine dedicated to keeping business up to Net speed. His fame is thanks to his book *How to Advertise on the Internet* – edited highlights on *http://www.phoenix.ca/sie/howto.html* – and his Net "poem" describing his failed marriage. But it's not making him rich, Strangelove claims. "It used to be Warhol's 15 minutes of fame where you'd make some money. Now, with the Net, there's fame for everyone – and every dollar has to be fought for."

He says that online advertising is going to be a battle between the "superhighway" – proprietorial, mass-produced stuff for the couch potato – and the fully formed Net catering for the needs of the "unique intellect". He's not sure who'll win, but favours the Net. "Come on, there's only 50 million books in Europe," he says. "Thirty million *people* are going to have an effect." Learn his lesson: Net physicians, brand thyselves. – *Robin Hunt*

e-mapping: Cyber Cafés



There are now at least nine cybercafés, a cyberpub and two cyberclubs in the UK. The novelty value alone is still sufficient to attract the punters. But will a thousand cybercafés bloom? (On our e-map, locations with a saucer have more than one cybercafé.)

Money and access is the issue: Heath Bunting never got his plans off the ground because he wanted his café to be a non-commercial facility. But the cybercafé generation are apparently becoming accustomed to paying premium prices. The cybercafés are a manifestation of the next direction for the Net: filthy lucre.

Cappucino costs you 90p at the Peak Art Cybercafé near Stockport, or £1.50 at London's Cyberia (but there's free Nescafé at the Byte centres in Belfast – which cater for unemployed 16-25-year-olds).

They may also be starting to break the boys-own stereotype: both the Byte centres and Peak Art claim at least one-third female imbibers.

Meanwhile, Cyberia, which established Europe's first cybercafé in London, has even trademarked the word *Cybercafé*. For now, cybercafé fever is still gripping the market.

"I see no evidence of it slackening off," said Mark Dziecielewski, creator of the *alt.cybercafes* Usenet group, who maintains the cybercafé Web guide. Internationally it's averaging a new one each day… The next big UK trend will be cyberpubs." – *Nick Rosen*

SCOOBY WHO?

UK Cybercafés

The Bytes: Falls Road, Belfast
CB1: 32 Mill Rd, Cambridge
Café Internet: 28 North John St, Liverpool
The Custard Factory: Gibb St, Digbeth, Birmingham
Cyberia: 39 Whitfield St, London,W1;
88 Hanover St, Edinburgh;
48 High St, Kingston upon Thames
Hub Intercafé: Walcott St, Bath
Peak Art Cybercafé: 30 Market St, New Mills, nr Stockport
Six Bells: Covent Garden, Cambridge
Web13: 13 Bread St, Edinburgh
Wet: within the Dry 201 bar, Hacienda Club, Manchester
Zap Club: Brighton Beach, opposite the Old Ship Hotel

The fast-expanding Cybercafé Web site is at *http://www.easynet.co.uk/pages/cafe/ccafe.htm*

► scientist attacked by the Unabomber. Now he's got an even bigger worry, according to the *New York Times*. "Obsessive software builders". Why? Their ignorance of romantic poetry, it seems. "Their push is to build software. I have a push to read Keats and I don't think they read Keats." ≡III Snow Joke: CompuServe's forthcoming "fully animated" online environment promises to feature a vivid range of graphical user representations (dragons, babies, reptiles and suburbanites), which they have called "avatars" – *à la* Neal Stephenson's *Snow Crash*. There are no details of whether it will also include pizza, sword-fighting, skateboards or a tedious and impenetrable sub-plot about the ancient Babylonians. ≡III

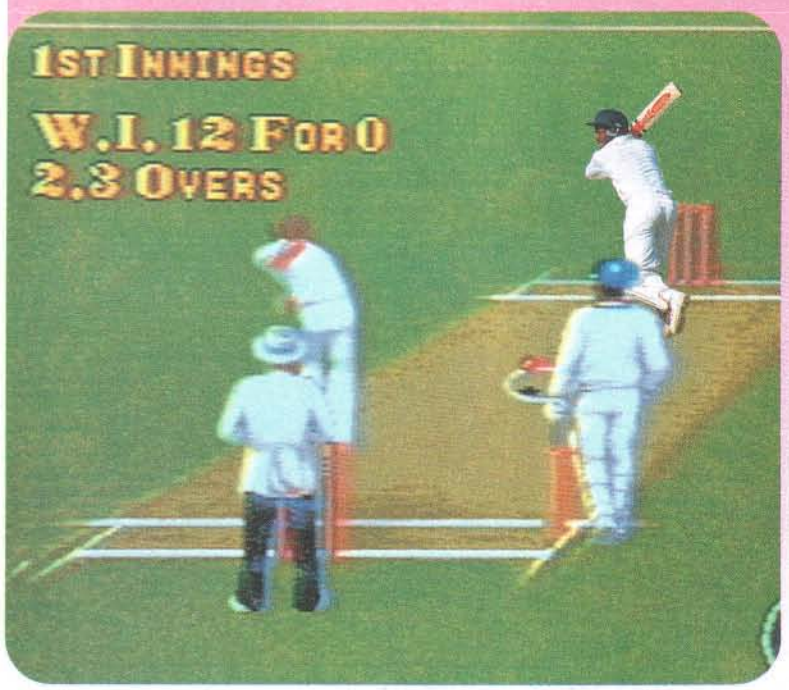
Cricket Darlings?

The latest release from Codemasters – the UK software house founded and run by the millionaire twentysomething nerd brothers Richard and David Darling (and their Dad) – is a truly terrific cricket simulation.

Forget the boundaries. *Brian Lara Cricket* is a game with a true slacker-generation heart. My favourite bit is the no-effort-required "spectator" option, where you simply sit back and watch as two computerised opponents slug it out.

Based in a converted farmhouse in Warwickshire, Codemasters was founded in the early '80s by the then teenage Darling brothers. One of their early successes was the Game Genie, a device that allowed you to cheat at Nintendo games. The business now turns over around £10 million a year and has a staff of 30.

Such success can be partly attributed to the company's mellow working environment. At their headquarters there is a tennis court, a duck pond – and even a lake where employees can go and take an afternoon swim if inspiration eludes them. The farmhouse has a summery atmosphere which has been nicely replicated in *Brian Lara Cricket*. With Pimm's and lemonade, Codemasters' latest release should make for some fun Saturday afternoons. – *Tom Hodgkinson*



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You Say You Want More Bandwidth?

Solitons and the erbium gain factor.

By David Voss

When network designers talk about *big pipe*, they mean optical fibre – strands of glass drawn as fine as human hair and as transparent as the purest crystal. The fibre allows huge amounts of data to be sent quickly and reliably between continents and enables new applications such as full-motion video-conferencing and high-speed computer networking. Right now, transoceanic fibre systems have a transmission speed of around 2.5 Gbits per second – to put this into perspective, they can send about one-and-a-half copies of the entire *Oxford English Dictionary* every second. Damn fast, you're saying, but even zippier lightwave systems are in the works. The combination of two technological developments – erbium-doped fibre and solitons – is likely to allow a transmission of more than 100 Gbits per second. At this speed, *Wired* could deliver to you 20 uncompressed electronic copies of this issue – text and graphics – per second.

From 1975 to the mid-1980s, the transmission capacity of fibre increased by a factor of 10 every four years. But then engineers hit a wall: it seemed that optical fibre had been fully optimised and speeds were stalled at 0.15 Gbits per second. The problem stemmed from the fact that light pulses decline in strength as they travel down an optical pipe. Many non-optical communications systems resolve this by using *repeaters* that grab the signal, amplify it and send it on its way. All kinds of ideas for building optical repeaters on chips were tried but tossed out – the chips had to convert the light pulses into electricity and then back into light, a process that proved to cause a bottleneck.

Because solitons are waves in perfect balance, very fast pulses can be used to send binary data without fear of wave dispersion.

The breakthrough came in 1987, when Emmanuel Desurvire (now with Alcatel France) and his colleagues at AT&T Bell Labs amplified optical pulses with a piece of fibre impregnated with the rare element erbium. The erbium ions in the glass are optically potent: when pumped up with infrared light, they want desperately to emit their stored power. When an optical data pulse comes along, the erbium dumps its energy by amplifying the pulse.

So rather than pulling the pulses off at one end, stuffing them into an electronic box marked "amplifier" and squirting them out again, the group at Bell Labs built the amplifier into the fibre. Desurvire was able to do this by building on the work of groups at Southampton University (which had already discovered the joys of erbium doping) and earlier Bell Labs teams that had built amplifiers with elements other than erbium. Desurvire put the pieces together and in one step created the enabling technology to jack up fibre-optic transmission capacity by a factor of a hundred.

Another promising technique involves the generation and propagation of optical solitons, or *solitary waves* – strange pulse shapes that could theoretically travel down a fibre forever. In another form, these curious beasts date back to 1834, when an engineer named John Scott Russell was relaxing near the Edinburgh-to-Glasgow canal, watching a barge pull up and stop. He noticed a water pulse leave the prow and begin travelling down the waterway. The sight of this hump of water moving along the surface, maintaining its shape, caused Russell to leap onto his horse and track the solitary wave. Weird waves come and go in a busy water channel, but Russell followed this one, moving about 9 mph, for a distance of about 2 miles. Being a proper protonerd, Russell rushed home and began playing with water tanks to study his findings.

Russell's solitary waves differ from ocean waves, the walls of water that draw surfers to the beach. As an ocean wave heads to shore, different pieces of the wave begin travelling at different speeds. The top of the wave overtakes the lower part and the wave breaks, creating a great tunnel ride for the intrepid surfer. Solitons, on the other hand, are waves in perfect balance. Their natural tendency to fall to pieces, either by spreading out or breaking, is cancelled by the non-linear effect of the shallow water channel.

This same effect was observed with optical pulses by Linn Mollenauer and his colleagues at Bell Labs. Because the optical power in a fibre is so confined, the strong electromagnetic fields interact with the material to produce non-linear effects. Just like waves travelling in shallow water, very-short-duration light pulses of the right shape can propagate as solitons. Thoughts of really high bit-rate, long-haul communications danced in the scientists' minds. While normal waves quickly crumble when they are sent at too high a rate, solitons retain their shape. But because of light's natural tendency to lose intensity when travelling through any medium, solitons also eventually break up and turn into noisy mush. Still no joy.

The turnaround came with the successful mating of erbium amplifiers and solitons. In 1989, Masataka Nakazawa at NTT Labs in Japan successfully generated soliton pulses in his erbium-doped-fibre amplifiers. The race to speed up and lengthen the transmission capacity was on. The battle for first place has bounced back and forth between NTT and AT&T ever since. Currently, NTT leads with its soliton-fibre experiments. Nakazawa has recently shown he can send soliton data down a fibre at 10 Gbits per second. Fancy multiplexing techniques and production-quality equipment should increase that by at least an order of magnitude, perhaps more. What is remarkable is that even after it had travelled 180 million km (or about 4,500 times around the Earth), NTT researchers saw no data degradation. Now *that* is one long and furious ride. ■ ■ ■

David Voss (dvoss@aaas.org), *a former optics jock, gave up aligning lasers by eye to become a senior editor of the US journal* Science.

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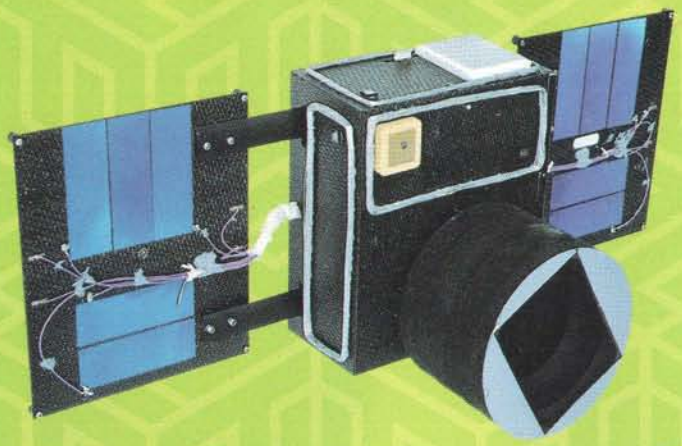
Edited by Dave Green



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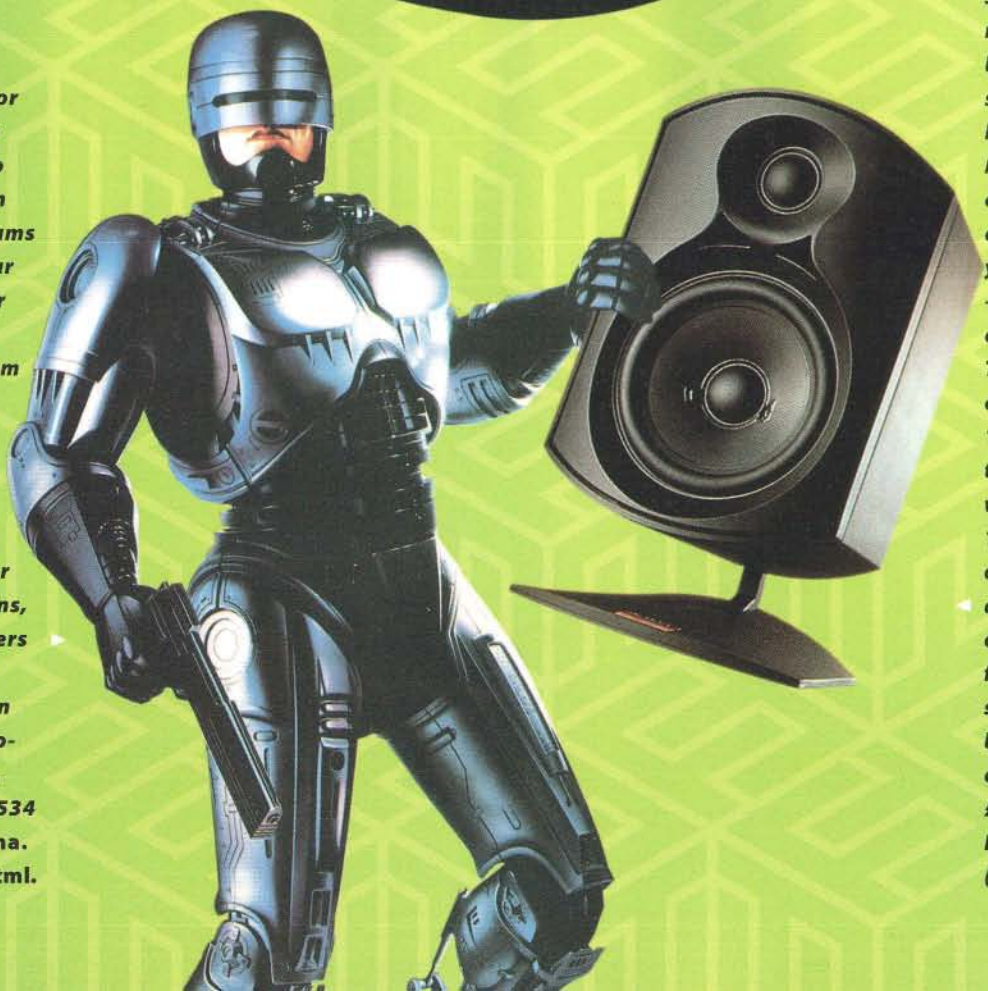

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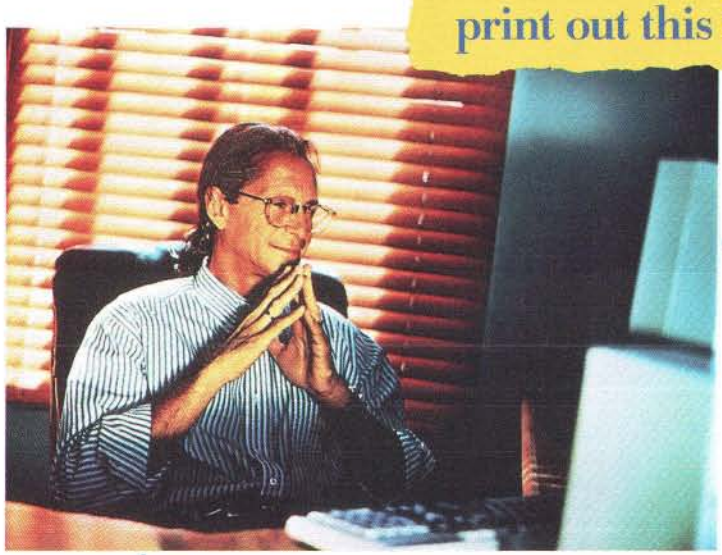

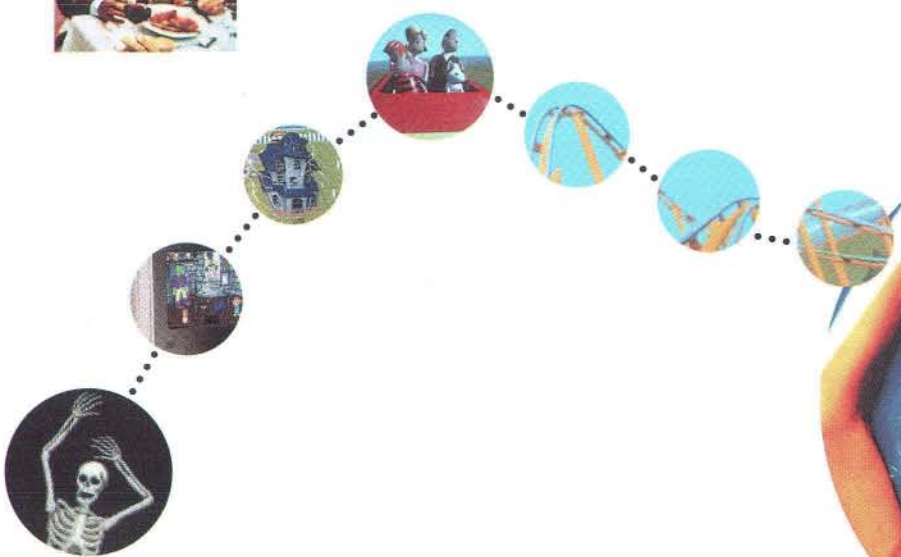

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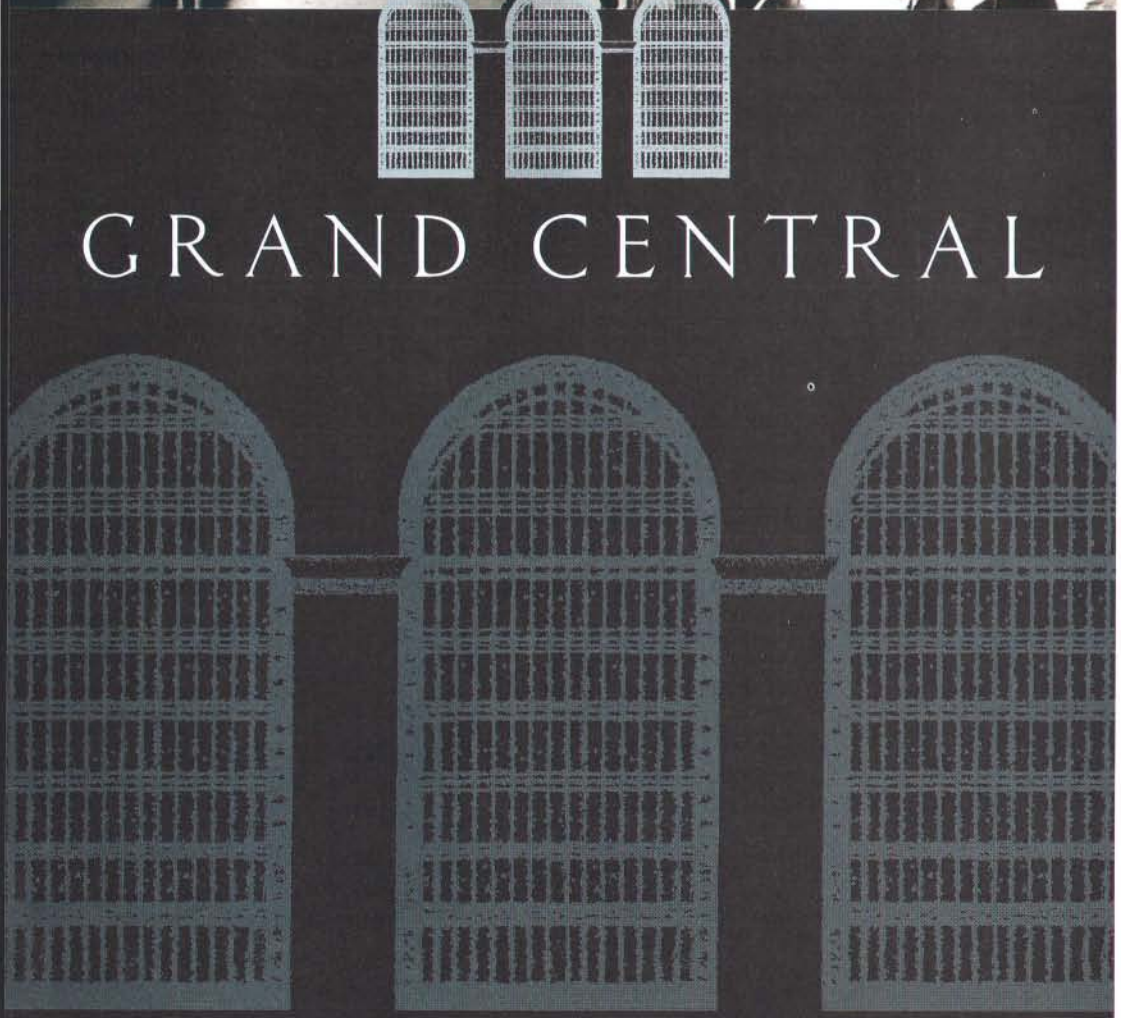

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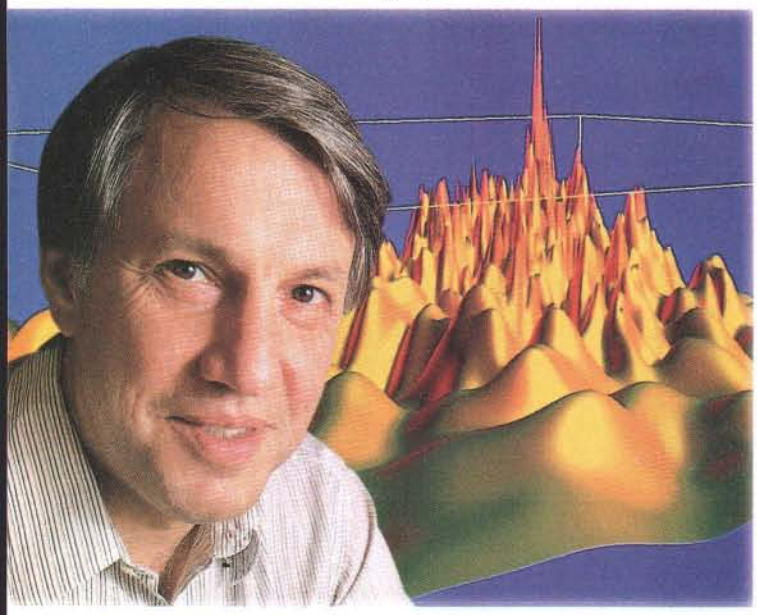
Goodbye Big Bang

Physicist Andrei Linde wants to know: since we live in this weird universe – fractal, self-replicating, inflationary – does that imply that it was created not by God, but by some physicist-hacker?

By Rudy Rucker

Andrei Linde, a 47-year-old physicist from Moscow, started teaching at Stanford University in 1990. He lives there with his wife, Renata Kallosh (also a Stanford physics professor, specialising in superstrings and supergravity), and his two sons, Dmitri and Alex. In 1982, he began formulating a new theory of the universe – an improvement on the big-bang model. He uses computer simulations for much of his research, and he has recently suggested that our universe may be the result of a physicist-hacker's experiment.

An attractive, tidily dressed man, Linde speaks with a thick Russian accent and a colourfully inverted syntax. His responses to the questions of mathematician Rudy Rucker have been smoothed by Rucker's interpolation and editing.



Andrei Linde in front of a fractal model of the universe. The traditional big-bang theory, Linde argues, is plagued by both physical and philosophical problems.

Wired: By now, most of us have become quite comfortable with the big-bang model of the universe, the notion that the universe was born as a cosmic explosion that gave birth to an ever-expanding ball of space. What's wrong with this idea?

Linde: There are a number of problems with the big-bang theory, but I'll start by mentioning two of a physical nature and two of a philosophical nature.

If you work out the physical equations governing the big bang, they predict that such a universe would be very small, even though we can see that our universe is large. One way to gauge the size of a universe is to talk about how many elementary particles it has in it – how many electrons, protons, neutrons and so on are present. When I look out of my window, the matter I see is made up of perhaps 10^{88} elementary particles, but a typical theoretical big-bang model envisions a universe with only 10 elementary particles in it! This is perhaps the most serious problem with the big-bang model. It gives a false prediction about the size of the universe. For a number of years, this mathematical flaw in the big-bang theory was not taken seriously by many scientists.

But even if a big-bang universe is of the proper size, the theory doesn't explain why different regions of the universe resemble each other. In a big-bang model, it could just as easily have happened that most of the galactical matter would wind up, say, in only one half of the sky, but we can observe that in our universe, the distribution of distant galaxies is uniform in every direction.

Then come the philosophical questions. What came before the big bang? How did everything appear from nothing? Another philosophical problem with the big bang is: why does it happen that our universe worked out to be the way it is? Why, for instance, do we have three dimensions of space and one dimension of time? The big-bang theory offers no satisfactory answers. We can begin to resolve the puzzles in the context of the theory of the self-reproducing, inflationary universe.

What is the theory of the inflationary universe?

There have been several versions of this theory. The first was proposed by the Soviet physicist Alexei Starobinsky, but it was rather complicated. Then a much simpler theory was put forth by Alan Guth, a physicist at MIT; we call his model *old inflation* now. Guth took the big-bang model and added the idea that in the beginning, the universe expanded rapidly – faster even than the speed of light.

By using the model of the universe rapidly expanding, you solve the problem of why it's so big, and why all the regions of the universe we can see resemble each other. The idea is that the visible part of the universe was inflated from some very small and homogeneous region, and this is why we see large-scale similarities.

However, it turned out that Guth's old inflation had a theoretical flaw that caused the universes of his scenario to become extremely homogeneous after the inflation stopped. I invented a *new inflation* theory which worked so-so until I realised that we could have inflation without the assumption that the universe began in a hot and dense state. Therefore, I dropped the idea of the big bang but kept the idea of inflation. In my model, inflation can start anywhere. This concept is called *chaotic inflation.*

What causes the inflation?

There are things called *scalar fields.* Scalar is a word physicists use simply to mean *a number* – this as opposed to a *vector*, which means something like an arrow. If you

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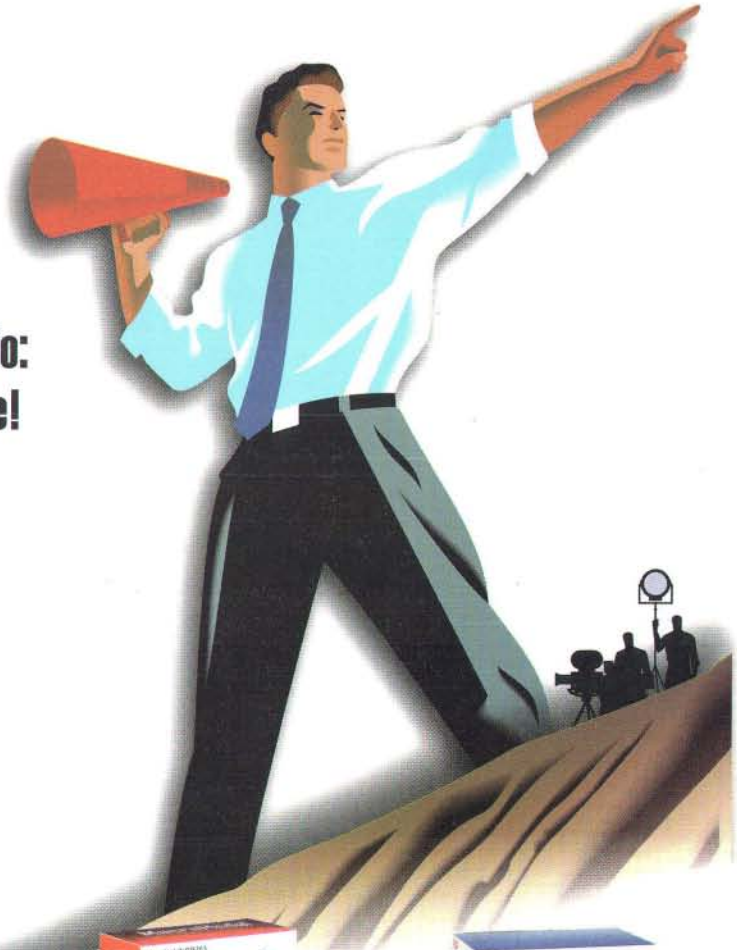

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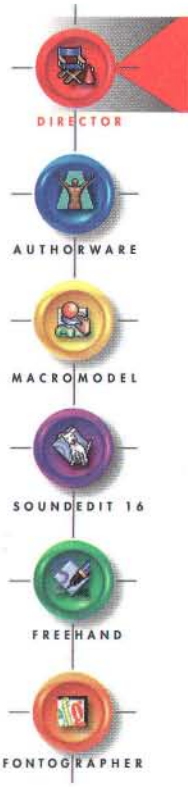

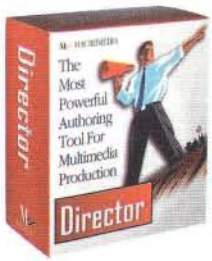

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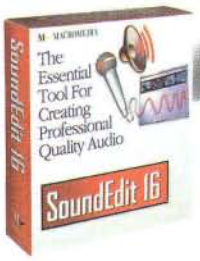

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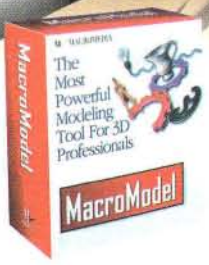

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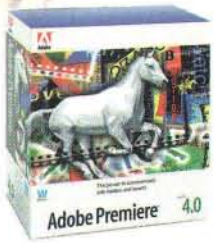

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In the fractal model, there is no real reason for the universe to stop growing – indeed, it is likely to keep growing and blooming in new regions forever."

have a scalar field, you have a certain number defined at each point of space. Air pressure can be thought of as a scalar field: there is a specific number that measures air pressure at each point. In the same way, temperature is a scalar field: at each point, you can measure the value of the temperature.

Two scalar fields that are important for inflationary theories are sometimes called the *inflaton field* and the *Higgs field*. These fields fill the universe and show their presence by affecting the properties of elementary particles. You don't notice a constant scalar field any more than you notice a constant air pressure or a constant electric charge. When there is a large air pressure, you get wind; when there is a large electrical charge, you get sparks; and when there is a large scalar field called the inflaton field, you get an expansion of space. Quantum mechanics implies that the scalar fields undergo unpredictable fluctuations as a result of the uncertainty principle. If there is a place where the fluctuations make the inflaton field sufficiently large, then at this spot the universe begins expanding very rapidly, which creates so much space that we can safely live there.

What about the "self-reproducing" aspect of your model?

The fluctuations that increase the speed of inflation can happen over and over again – because of the essential fuzziness that the uncertainty principle of quantum mechanics introduces into the equation. This makes the universe self-reproducing; the universe actually replicates itself in all its forms.

The standard big-bang theory depicts a homogeneous universe that looks like a single bubble. But if we take into account quantum effects, the self-reproducing inflationary universe is a bubble producing new bubbles producing new bubbles producing new bubbles and so on. This kind of repeatedly branching pattern is what mathematicians call a fractal. A fractal pattern is characterised by the property that the small bits of the pattern are exact replicas of the whole pattern. An oak tree, for example, is like a fractal in that a single branch of an oak resembles a scaled-down model of the entire tree. Another example of a fractal is a mountain range. If you chop off the top of a mountain and look at it closely, it resembles the whole mountain range; a single rock on the mountain resembles a whole mountain in itself.

So, we think of the self-reproducing inflationary universe as a fractal. The big bang works as a description of each particular bubble, but it cannot describe the growing fractal. In the fractal model, there is no real reason for the universe to stop growing – indeed, it is likely to keep growing and blooming in new regions forever.

Can you help me visualise this fractal self-reproducing inflationary universe?

There are two kinds of pictures I like to use. In one, I draw something that looks like lots of separate bubbles connected to each other where they touch. It looks a little like the linked flotation bladders on seaweed.

In the other picture – and I've done several computer simulations of this image – I think of space as a flat sheet. Our space is three-dimensional of course, but I represent it in this picture as a two-dimensional rubber sheet. Then I add a randomly fluctuating scalar field, an inflaton field, and I represent the regions where the inflaton field has a low numerical value by valleys, and the regions where the scalar field is large by peaks.

The peaks are the places where inflation takes place; at these places, the universe will rapidly expand. I can't show the inflation in my picture, but I can represent it by putting new, secondary peaks on top of the first peaks, third-level peaks on top of those peaks, and so on. It is like a mountain range.

What is a little hard to grasp is that the two images represent the same thing. The peaks in one image correspond to the bubbles in the other. A peak that rises on top of a peak is like a bubble that newly swells out from the side of a pre-existing bubble.

Can we travel to the other bubbles of our fractal universe?

In the future, our sky will look much different – as the stars in our neighbourhood begin to die. Then we will see into the other parts of the universe, parts with different laws of physics. Can we use the energy in our cooled-off bubble? Can we fly to the other tips of the fractal? Can we go there and live comfortably? The theory of cosmic flights over vast distances suggests that even if you were to travel at the speed of light, you lose so much time that when you get to another part of the universe, it will be cold and empty there.

You say that some of the different bubble universes have different laws of physics – how does that work?

We've talked about the inflaton field responsible for the universe's expansion. As I mentioned before, it seems that there may also be a second scalar field that creates different kinds of physics in different regions of the universe. This is the Higgs field. There is one overall law of physics for the whole universe, but the Higgs field makes for different realisations of this law. The principle is similar to that of water existing in different phases.

What if I could somehow fly up to the edge of a region of the universe with different physics? How would it look?

Between the different regions of the universe, there are boundaries called *domain walls*. There is a tendency of the domain walls to smooth out. You might think of them as being a little like the boundaries of soap bubbles in a foam, with the regions of different physics the insides of those bubbles. The domain walls might be irregular to start with, but over time they straighten out. In addition, the regions will tend to shrink or expand, and this expansion is in fact very rapid – it is at a speed approaching the speed of light. This means that the domain walls will be moving in one direction or another with a speed approaching that of light.

So, first of all, it would be difficult for you to reach a domain wall if it is moving away from you at any speed. And if it is moving toward you, it would be difficult to run from it because it will be moving very fast. In fact, if a wall moves toward you at the speed of light, then you first see it only at the moment it hits you. And then you would almost definitely die, since the physics on the other side of the wall would be different and unlikely to support your form of life. You will be exactly like a fish out of water.

The regions of the universe that grow faster contain more volume, so perhaps they contain more inhabitants. This is a bit like Darwinian fitness, without hate or killing.

But we don't need to worry too much; the distance from us to this next domain wall is typically estimated to be much greater than 10 billion light years, so we may live for now.

Might we say that the regions with different physics compete with each other?

The regions of the universe that grow faster contain more volume, so perhaps they contain more inhabitants. This looks like Darwinian fitness. Should we discriminate and say those with greater volume are winners? There is a lot of place for losers as well; everything that can exist tends to have room for its existence in the self-reproducing inflationary universe. We can think of a Darwinian process without hate and killing.

How did the whole process begin?

Maybe the universe didn't have a beginning. There are some philosophical problems with the idea of the universe having a beginning. When the universe was just created, where were the laws of physics written? Where were the laws of physics written if there was no space and no time to write them? Maybe the universe was created without obeying any laws, but then I don't understand. Well, maybe the laws and the universe came into existence simultaneously. Quantum mechanics might say that our universe together with its physical laws appeared as a quantum fluctuation, but how were the laws of quantum mechanics written before creation?

In one of your papers, you talk about relating the nature of our consciousness to our universe. What do you mean?

For me, the investigation of the universe is mainly a tool for understanding ourselves. The universe is our cosmic home. You may imagine you can learn something about your friend by looking at how his house is built. My final purpose is not to understand the universe, but to understand life.

An example of this is the question of why we humans see time as passing. According to the branch of physics called *quantum cosmology*, the universe is best represented as a pattern called a *wave function* that does not depend on time. But then why do I see the universe evolving in time? The answer may be that as long as I am observing the universe, the universe breaks into two pieces: me and the rest of the universe. And it turns out that the wave function for each of these separate pieces does depend on time. But if I merge with the universe, my time stops.

You've suggested that it might be possible to create a universe in the laboratory by violently compressing matter, that 1 milligram of matter may initiate a self-reproducing universe. How would this work?

It would be hard. You have to do more than just compress the matter. But with high temperatures and quantum effects, there is a chance of creating a universe. Our estimates indicate that you would need a very good laboratory indeed. And it is not dangerous to try. This new universe would not hurt our universe; it would only expand within itself – like bulging a bubble out from the side of our space.

Can you imagine there being any kind of economic or spiritual gain from creating new universes? Might this lead to a Silicon Valley industry or to a cosmological cult?

The question is: is it interesting to create a universe? Would you have a profit or benefit? What would be the use? Suppose life in our universe is dying, and we make a small private universe we can jump into so we have a place to live. But it's not easy to jump between universes. When we create a universe, it is connected to our universe by a very narrow bridge of space – we can't jump through it, and the new universe will repel us because it is expanding.

Well, maybe you can get energy from the new universe? No, you can't get energy because of the law of energy conservation. The new universe gets its energy internally, and the energy has to stay inside there. We can't get in, we can't use the energy, but maybe we can do like we do with our children: we teach them and we live on in them. Maybe we can give knowledge and information to the new little universe.

Would you be able to communicate? To send information to and from that universe you helped create?

It is not so easy to send information inside. Say I wrote a message on the surface of an inflationary universe. But then the letters expand so much that for billions of years to come, each race of people in the universe will be living in the corner of just one letter. They will never see the message. The only way I have found to send information is strange and unusual. If I create an inflationary universe with a small density, I can prepare the universe in a particular state that corresponds to different laws of physics, masses of particles, interactions, etc. I can imagine a binary code describing all possible laws of physics; this would be quite a long sequence. So, if I am preparing a universe in some peculiar state, I can send the message encoded in the laws of physics.

Can I send a long message in this way? Let's think about our own universe. Let's imagine that someone made our universe as a message. If our universe is perfect, with all particles having equal masses and charges, then the laws of physics would really be trivial, and it would be a very short message. But our particle physics looks weird, and it has a lot of information. We get these strange numbers; there is no harmony when we try to make sense of it all. There is information instead of harmony. Perhaps it would be more precise to say the harmony is there, but it is very well hidden.

To send a long message, you must make a weird universe with complicated laws of physics. It is the only way to send information. The only people who can read this message are physicists. Since we see around us a rather weird universe, does it imply that our universe was created not by God, but by a physicist-hacker?

I don't entirely think of this possibility as a joke. Even if something seems counterintuitive, you must be honest and follow the thought line and not be influenced by the common point of view. If you agree with everything everybody else thinks, you never move. ■ ■ ■

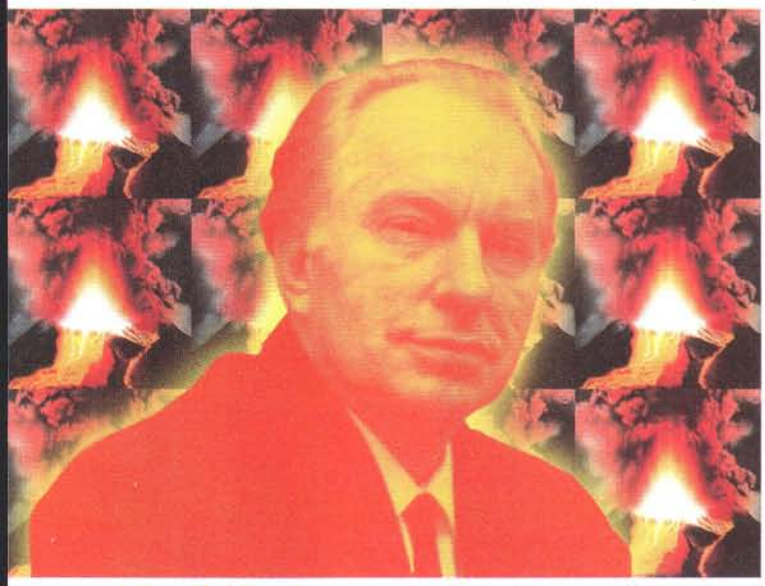
Rudy Rucker (rucker@jupiter.sjsu.edu) *has written a novel* The Hacker and the Ants *about near-future Silicon Valley. To e-mail Andrei Linde:* linde@physics.stanford.edu.

War of the Words

The Church of Scientology has its critics on the Net. The Church has lawyers, the critics have computers. The battle is on.

By Wendy Grossman

Homer Wilson Smith is worried. It's April 9, 1995 and someone using the name Scamizdat is posting long – 50 to 60 pages – excerpts of material marked "twenty-one documents from Scientology secret practices". Some of it has come through the anonymous re-mailer he operates and he's started getting phone calls asking him where the stuff came from. The answer is another re-mailer. (Scamizdat is being very careful to chain through multiple systems to protect his or her identity.) Smith won't tell his caller which re-mailer without a court order. He has posted messages saying all this onto the Net and is begging everyone to behave responsibly. His caller is Helena K Kobrin. She is an attorney acting for the Church of Scientology International (CoS). The last time she made calls like this, they were followed soon afterwards by policemen with search warrants.



L Ron Hubbard's writings are the "Sacred Scriptures" of the Church of Scientology. But on the Net, nothing is sacred.

Smith has good reason to be worried. Like it or not, his desire to pursue his interest in Scientology has caught him up in one of the most bitter battles ever fought across the Internet.

The story of Scientology versus the Net is not a tale of friendly Nethead-to-Nethead hostilities like 1994's kittens-in-the-microwave flame war between *alt.tasteless* and *rec.pets.cats*. This is an out-and-out war between two alien cultures – two worlds whose common language masks the gulf between them. And this fight has burst the banks of the Net into the real world of policemen and lawyers, search and seizure. Ultimately however, despite all the drama, what matters in this story is the future of free speech on the Net.

While the Internet has empowered millions to speak more freely – and more broadly – than before, this is not in practice an unconditional freedom. Messages can be intercepted as they traverse the network. Computers can be seized when they contain allegedly purloined intellectual property. And the security of anonymous re-mailers, which allows accusations to be made from behind a technological veil of secrecy, can be pierced by Interpol. Everybody now knows how the Internet can be used by friendly nerds to swap hints about obscure Unix commands or to argue about sex and politics. But Scientology's story is different. It shows that technology – not to mention lawyers – can be used to try to control speech as well as to free it. It shows what battles will have to be fought and what compromises thrashed out, as the Internet evolves from being a sort of intellectual tea party, where nice intellectuals discuss nice ideas, to become the arena of real politics, where people with passionate beliefs just want to get their stuff done.

We hold these truths

alt.religion.scientology was never a quiet newsgroup. It was created on July 17, 1991 by Stuart Goehring. Goehring says he started the newsgroup half as a joke and half as a place to discuss the truth about this religion. But he can have been no Scientologist at the time. He forged the signature "*miscaviage@flag.sea.org*" on to the message which was used to fund the group – and no true Scientologist would have misspelled the name of CoS leader David Miscavige. In any case, sceptics and believers alike were attracted to the group. While never even coming close to agreement, they managed to exist in the sort of tense balance that the Net seems to specialise in. They even hammered out a more or less stable agreement to have multiple FAQs that introduce newcomers to both sides. These persist to this day. While each side criticises the others' writings, the FAQs do not mysteriously disappear from ftp sites. Even now, the old-timers on the group have a certain tolerance for the Dutch former Scientologist who calls himself "Ron's Inspector" and believes he's in touch with L Ron Hubbard telepathically.

Hubbard was a pulp-fiction writer by trade, who founded Scientology in the 1950s, and died in 1986. His published books, monographs, internal policy documents and taped lectures form what the Church of Scientology calls its "Sacred Scriptures". The more advanced materials are kept closely guarded. Hubbard claimed that exposure to the secrets of an "Operating Thetan", as the CoS refers to its acolytes, could harm, even kill, the partly initiated. As the arguments over Scientology heated up, protecting these materials from disclosure and criticism rapidly moved to the centre of the fight.

One of the first steps towards open warfare over Scientology was the emergence, in about 1992, of a group that wanted to separate the church and its scriptures. Calling themselves the "Free Zone", these are people who have left the CoS but still want to practice its teachings – use "the tech", as they say. Former Scientologist Homer Smith is one of these. Wanting to encourage serious discussion of the tech, Smith set up a second newsgroup, *alt.clearing.technology*. Occasionally, in older guides to the Internet, you'll see a note explaining that *alt.clearing.technology* is for discussing acne cures. This was another Usenet joke, perpetrated by Chris Schafmeister, a graduate student in molecular biology at the University of California at San Francisco (UCSF) and one of the first sceptics to join the discussion of Scientology on the Net.

Perhaps because of the threat implied by the Free Zone to the CoS's control over its scriptures, or perhaps simply because Usenet was beginning to move off the terminals of techies and into the mainstream, by early 1994 *alt.religion.scientology* had begun to attract more than passing interest from official – or at least official-sounding – circles in the Church of Scientology. Chris Schafmeister, he of the acne cures, made the connection. A strident critic of Scientology, Schafmeister says his interest in Scientology began when he started seeing posters on the walls of the medical school at UCSF. He was, he says, "really, really upset" at the way these posters targeted the sick, the sad and the bereaved, hoping to get them into $60 Scientology courses. Accordingly, he took to spending his study breaks arguing against the organisation on Usenet.

It was, he says, a Scientologist who gave him a copy of a letter from a CoS staffer named Elaine Siegel. Appalled by its content, he promptly posted it on *alt.religion.scientology*. Siegel identified herself as writing from the Office of Special Affairs International (OSA), which former insiders say is the CoS's security branch. Addressed to Scientologists on the Net, the letter said in part, "If you imagine 40-50 Scientologists posting on the Internet every few days, we'll just run the SPs [for "suppressive persons", which is how Scientologists refer to those excommunicated from their church] right off the system. It will be quite simple, actually." She closed with, "I would like to hear from you on your ideas to make the Internet a safe space for Scientology to expand into."

CoS lawyer Helena Kobrin, asked recently about the letter by e-mail, said, "Ms Siegel's letter was not an official Church policy." Things might be different now if the CoS had said so at the time. The letter was much copied and its widespread circulation brought a new group into the arguments over Scientology: people who wanted to defend the Net against what many saw as an attempt to censor it. Many of them knew nothing about Scientology except that letter, and they were incensed. Others knew a lot about Scientology, and were incensed for different reasons. Chief among them was Dennis Erlich.

Erlich was in the CoS for 15 years. He left in 1982 after what he describes as a failed attempt to reform the CoS from within. "That made me *persona non grata*, and they couldn't work with me because I wouldn't follow their orders any more." He was declared an SP, and has since devoted himself to debunking the CoS at every opportunity. He is most definitely not a Free Zoner. Indeed, so fierce are Erlich's convictions that it is hard to imagine a situation in which he could come to any sort of amicable agreement with Scientologists or they with him.

By the end of 1994, *alt.religion.scientology* was transformed from newsgroup to battlefield. Over its electronic terrain were fought a confused series of sharply escalating skirmishes between the Church of Scientology, its supporters, its detractors and a variety of other groups – some of whom got involved to defend freedom of speech on the Net and others who seem to have been attracted mostly by the prospect of a good fight. There have as yet been no outright winners or losers. But the blows dealt out to the wounded raise fundamental issues about the Internet and its freedoms.

The Church's secrets are closely guarded. Hubbard claimed that exposure to the secrets of an "Operating Thetan" could harm, even kill, the partly initiated.

Duelling cancel-bots

Shortly before Christmas 1994, messages started mysteriously disappearing from *alt.religion.scientology*. The contents of all of them are not known, for obvious reasons. But there was no shortage of people willing to guess at the reasons for their disappearance, or to point an accusing finger. The hard part was getting any real evidence as to who was doing what. For in the self-organising world of the Net, things can be made to disappear almost as spontaneously as they appear.

Most newsreaders have cancellation facilities built into them. This enables someone to take back their words – for whatever reason – by sending out a cancellation message, which instructs the system to ignore the cancelled posting. Surprisingly, this does actually work. You'd think the cancel message would just chase the original message around the Net and always lose. But because of the way Usenet is constructed, the cancel message is unlikely to follow the same route as the original posting, and as long as it gets to the centres of distribution first, it will win. And in practice it often does.

To cancel somebody else's message, all the would-be censor has to do is to forge that person's identification to the cancellation message – which is not all that hard to do. There are legitimate – or at least Net-approved – reasons for forging cancellations. CancelMoose, for example, removes spam, the post-Canter & Siegel term for messages inappropriately posted all over the Net. When activated, the CancelMoose typically culls messages posted to 25 or more newsgroups, of widely varying content.

Typically those who operate under the name of CancelMoose take full, open responsibility for their actions – in fact they advertise them as a sort of public service. The cancellations on *alt.religion.scientology* were different. The messages which disappeared were sent only to a single newsgroup – and nobody ever claimed responsibility for the cancellations. So this being the Net, a program was developed to get a look at what was being cancelled: Lazarus.

Lazarus was Chris Schafmeister's idea. Every Usenet message is assigned a unique identifying number when it's written. Lazarus is set to work at a site that has disabled its cancellation facility (a few do, for various reasons). Once there, it compares the identification of the cancelled message with those of the messages on some newsgroup, in this case *alt.religion.scientology*. In theory, Lazarus could reinstate the posting, but because people do legitimately cancel their own postings sometimes, Lazarus just puts up a note saying that a message has been cancelled and it reports any information about the reasons for cancellation that might

have been included in the cancellation message. It's then up to the original poster to reinstate the message if he or she wants to.

Homer Smith took the idea and implemented it as a Perl script that is available to anyone on the Net, although it takes some skill to use. "At least we can see when messages have been cancelled," says Schafmeister. Lazarus cannot pierce the forgery to discover who has cancelled which messages. But when messages from critics of Scientology began to disappear, some on the Net were only too ready to jump to conclusions – even more so when Lazarus began reporting that messages had been "CANCELLED BECAUSE OF COPYRIGHT INFRINGEMENT".

Nobody has claimed responsibility for cancelling the messages on *alt.religion.scientology*. When asked about the cancellations, Helena Kobrin of the CoS replied in an e-mail message: "in an effort to protect its rights, the Church has contacted several Computer Bulletin Board operators in recent months who, when apprised of the illegal and offensive nature of the postings, agreed to remove the infringing materials from the Net." But whatever was going on, many on the Net were not about to take it lying down.

"Just about everybody got hit," wrote William C Barwell, who signs himself "Pope Charles" and is one of the joking Church of the SubGenius, Praise Bob! crowd. "I myself had two posts cancelled." Then Barwell discovered the law in the form of USC Title 18, part I, chapter 121, "Unlawful access to stored communications". This includes provisions outlawing unauthorised access to and malicious destruction of an electronic message; it also prevents unauthorised access to or alteration of electronic communications.

Barwell felt all of these conditions applied to the forged cancellations. At the beginning of March, Barwell wrote a letter to the FBI asking them to enforce the code, with copies to Netcom and his own service provider, Neosoft. Netcom closed the accounts of those cancelling from its system. When cancellations started coming from Deltanet, a Southern Californian Internet-service provider, accounts there were also rapidly shut down. But more recently cancellations have moved to public news servers like the one at London's Demon Internet Limited, which make it relatively easy to cancel messages anonymously.

You can't say that here

Making messages disappear is only one way to stop annoying discussion (as the critics tell it) or copyright violations (as the CoS puts it). The Church of Scientology was pursuing other tactics. One was to stop messages at their source, the other to put an end to the whole newsgroup. On January 3, 1995, about a week after the cancellations started, Julf Helsingius, the operator of the best-known anonymous re-mailer, *anon.penet.fi*, posted a copy of a letter he had received from Helena Kobrin on behalf of Thomas M Small, counsel for the RTC and Bridge Publications (publisher of Hubbard's work). Kobrin was requesting that he block access from his re-mailers to *alt.religion.scientology* and *alt.clearing.technology* on the grounds that the re-mailers were being used as conduits for stolen copyrighted materials. Copies of the letter had also been sent to four other anonymous re-mailers. On January 9, Helsingius replied that monitoring postings is impossible, and that he didn't feel blocking any groups was appropriate – in other words, forget it.

"I am thankful I'm not having to face the Net... It's going to be to Scientology what Vietnam was to the US... their only choice is to withdraw. They cannot win"

On January 11, Helena Kobrin posted a message in *alt.config* – the newsgroup in which users propose the establishment of new newsgroups in the *alt.** hierarchy, and the deletion of old ones. Kobrin's message said "We request that you remove the *alt.religion.scientology* newsgroup from your site. The reasons for requesting its removal are: (1) it was started with a forged message; (2) not discussed on *alt.config*; (3) it has the name "Scientology" in its title which is a trademark and is misleading, as *alt.religion.scientology* is mainly used for flamers to attack the Scientology religion; (4) it has been and continues to be heavily abused with copyright and trade secret violations and serves no purpose other than condoning these illegal practices." As is usual with any attempt to impose authority on the anarchic *alt.** newsgroups, Kobrin was told to forget it.

Enter Interpol

Meanwhile, back at the newsgroup, reasoned debate – well, more or less reasoned, at least – was degenerating into name-calling. Bashers posted affidavits from former Scientologists alleging corruption; Scientologists posted critiques of those affidavits alleging that the authors were known criminals. One such affidavit was signed by Erlich's wife, Rosa, and alleged he had abused their daughter. This didn't deter Erlich, who denied the allegations and went on posting quotations from CoS materials and his critiques of them.

Erlich's Usenet feed comes from a small BBS in the LA area called *support.com*, which in turn gets its Usenet feed from Netcom, one of the largest US Internet providers. The sysop of *support.com*, Tom Klemesrud, says that in early January he was approached by Helena Kobrin, who requested that he delete Erlich's Internet account, which he refused to do. In mid-January, Klemesrud reported a truly bizarre incident in which his apartment was smeared with blood by a young woman he had met in a bar – although exactly how and why nobody is ever likely to know for sure. Klemesrud claims that this was an attack meant to frighten him into removing Erlich's account.

On January 23, a poster signing himself "-AB" from *an144108@anon.penet.fi*, an account on Julf Helsingius's anonymous re-mailer in Finland, put up an opposing account, allegedly based on an interview with the woman in question, that claimed that Klemesrud was the attacker rather than the victim. And here the tale grows even more bizarre. On February 2, Helsingius was contacted by an American CoS representative saying that information from a closed, private CoS system had been made public through *anon.penet.fi* and that the CoS had reported a burglary to the Los Angeles Police Department and the FBI. The representative wanted the identity of the individual who had posted the material. Helsingius refused, and was told a request was on its way to the Finnish police through Interpol.

On February 8, the Finnish police arrived with a warrant. Helsingius managed to give up only the single ID that the CoS wanted instead of his entire database of 200,000. He says that within an hour he was told the information had been passed on to the CoS. Helsingius has since confirmed that the ID the CoS wanted was *an144108@anon.penet.fi*. In an e-mail message, Helena Kobrin said of the *anon.penet.fi* raid: "The material that was stolen happened to relate to an investigation

being conducted by the Church's lawyers into false allegations about the Church that had been posted on the Internet by Mr Erlich and Mr Klemesrud. These allegations centred on an incident involving a woman whom Mr Klemesrud had met in a bar, which the investigation proved were completely unfounded." Asked if further action is being taken against the anon-poster whose ID was handed over, she said, "The matter is under investigation. I cannot comment." The CoS, when asked who was undertaking the investigation, did not reply.

Drop that disk

On the day that the Finnish police visited Helsingius, the Religious Technology Center (RTC), the CoS arm that is the exclusive licensee for some of Hubbard's works, filed a complaint in San José, California, against Dennis Erlich and his Internet-service providers, Tom Klemesrud and Netcom. The complaint was that Erlich had been posting CoS materials in violation of copyright and, in the case of upper-level materials, posting unpublished and confidential materials. The CoS calls them trade secrets, and says that the issue is one of theft, not of free speech.

On February 10, Judge Ronald M Whyte in San Jose, California, issued a temporary restraining order against all three – Erlich, Klemesrud and Netcom – which commanded them to stop. Erlich argues that all his postings are merely fair use. "The most effective way I can discredit the cult is to use their own documents to show what they're about." On February 13 Erlich's residence in Glendale, California, was raided. Erlich claims his constitutional rights were violated by the raid, in which, he says, floppy disks, books and papers were seized, files were deleted from his hard drive and his house was comprehensively searched and photographed. Afterwards, he claims, two of his computers would not boot properly and he was left with no back-ups from which to restore his system; nor was he given an inventory of the materials that were taken.

There has been a flurry of legal activity since then. Thanks to the Electronic Frontier Foundation, Erlich is being defended by the high-profile California law firm of Morrison Foerster. So far, the temporary restraining order against Klemesrud and Netcom has been dissolved. Although the CoS has filed a request to have it reinstated, the Net is breathing a sigh of relief.

As both Klemesrud and Netcom explained, they know they cannot police the flow of information across their computers. Even if Erlich has committed a crime, to hold them responsible would be like charging the post office for complicity in mail fraud. It would also bring to an end the Net as we know it. As for Erlich, however, the CoS has also filed a motion to hold Erlich in contempt of court for reposting one of the articles the CoS objected to in the first place.

In a prepared statement, Leisa Goodman, media relations director for the Church of Scientology International, wrote: "Numerous attempts had been made by the Church's lawyers to persuade Erlich to halt his unauthorised, wholesale postings of the Church's religious scriptures, which went way beyond the concept of fair use and constituted violation of copyright law." Later in the same statement, she wrote, "Freedom of speech does not mean freedom to steal. Erlich's attempts to misdirect and misinform the media are intended solely to divert attention from his own unlawful actions. He has spread polemic and sometimes obscene messages about the Church over the Internet – also a smokescreen to divert attention away from his illegal activities."

Making messages disappear was one way to stop discussion on *alt.religion.scientology*. Another was to attempt to close down the newsgroup.

The talk goes on

So what does it mean, all this argument? Well, for *alt.religion.scientology*, warfare has brought unprecedented popularity. Throughout March, *alt.religion.scientology* grew to something like 2,500 postings a week – including something to offend everyone – and the battles began spilling across into *alt.journalism*, *news.admin.misc*, *alt.current-events.net-abuse* and even, with the Scamizdat postings, *alt.2600* – which wasn't too thrilled at the incomers, even though they had to admit there was something like hacking involved in anonymously posting secret scriptures. By almost any measure – messages, volume, readership – the newsgroup had become one of the 40 most popular on the Net. Some messages are, worryingly, still continuing to disappear, but attempts to censor the newsgroup as a whole have backfired – spectacularly.

Having so far failed to beat the newsgroup, the CoS is joining it. More and more "official posters" are joining the *alt.religion.scientology* – indeed some joke that the church members are so prolific that they must post in teams. One of these, Andrew Milne, who describes himself as a "Church staff member" has become one of the three most prolific posters to *alt.religion.scientology*.

Stu Sjouwerman, a Scientologist and part-owner of a computer company, has started a mailing list for Scientologists, which, he says, is "working out great! Over 200 participants and expanding rapidly. About 15-20 messages per day!" And then there's Scamizdat, still posting Scientology scriptures anonymously – taking the law into his own hands.

A day or so after I'd let it be known I'd welcome a quote from this person about his or her activities, an anonymous message landed in my e-mail box. It read: "I am just a Netizen fighting a litigious cult in the age of information. While the Net has its own perpetual struggles among its orthodoxy and revisionists, it strobes into immobility lawyers and money that darken the battles in the ordinary world. Once a representative portion of the Scientologist cartoon mythology is posted into undeniable digital immortality I will snow crash back into oblivion. SCAMIZDAT."

But did it all matter? Sjouwerman, snug in the success of his mailing list, dismisses it as another electronic controversy. "*alt.religion.scientology* is less than 0.002 per cent of the whole Net. Couple of dogs barking, that's all."

Robert Vaughn Young takes a darker view. He is a former Scientologist who doesn't post to the newsgroup, but nonetheless seems to be constantly aware of what's going on in it. He was also a national PR spokesman for the CoS. "I am thankful I'm not having to face the Net," he says, frankly. "It's going to be to Scientology what Vietnam was to the US." In the end, he says, "their only choice is to withdraw. They cannot win." The result, he thinks, will be to "create, for the first time, the first place in the world where Scientology can be openly and freely discussed." If that's true, given that freedom of speech and freedom of religion have traditionally gone hand in hand, that would be a victory for everybody. ■ ■ ■

Wendy M Grossman (wendygo@delphi.com) *is a writer, recovering folksinger, and founder and former editor of UK's* Skeptic *magazine.*

Into Uncharted Territory

Jonathan Waldern demonstrated Virtual Reality on *Tomorrow's World* a decade ago. Now he's talking immersion.

By Ivor Benjamin

Jonathan Waldern, 35, is Chief Executive Officer and "software founder" of Leicester-based Virtuality Group Plc, formerly W Industries, the world's largest supplier of those car-sized virtual-reality units you've seen in arcades and cafés. From early attempts to simulate artificial worlds with blocky graphics and boom-mounted TVs in the 1980s, to the current release of second-generation virtual-reality arcade hardware, he has remained one of the key figures in the global VR stampede.

Wired: You have always talked up entertainment as the cutting edge of virtual reality: do you still believe that's true?

Jonathan Waldern: Entertainment is *the* leading-edge application for computing in the future. I think that many of the applications we'll find in future computing trends will be driven by integration for entertainment purposes – speech analysis, speech synthesis, advanced networking, artificial intelligence. The whole drive of VR as a medium for non-linear storytelling is pushing the envelope. A lot of the major manufacturers in the technology and computing food chain realise this – and are looking closely at innovations in VR for their direction.

Solitary entertainment used to be VR's killer app. Now with the third generation imminent, the future is networked.

The PC market has been "ramping up" to multimedia and 3-D. Games like *Doom* and *Descent* are a taster of things to come. With Virtuality placed very much in the arcade arena, do you see this PC market as a threat to the arcade – or do the two feed each other?

We don't only sell to arcades. We sell to multiple uses, multiple sites. Night clubs, theme parks, cruise ships, supermarkets – we're providing for a broader age group than the *Doom* players. The PC is a growing market and we have firm plans for our entry into the marketplace.

Do you ever see VR coming to the Internet?

People are looking towards using the Internet much as the French have been doing for years with Minitel. In that respect the Internet, as it is now, propagates the idea of IT being available, applicable and providing a wealth of information services. Except that the product is still way too crude. It's time-lagged – you have to use a keyboard, watch a screen, try and navigate who said what and when they said it, and how you respond to it, and how somebody else has replied to it or how it has influenced the way the conversation's going. To most people it's unrelaxing and completely archaic.

Our concept of entering a cybercafé and chatting with somebody else as you would in a normal café, while still retaining the disparate and international flavour of the Internet, is already well developed. Clearly VR will be the metaphor that provides that realisation. If somebody appears behind you and says something, you aren't going to move your TV set around to look behind you...

So the communication paradigm moves from telephone and text to VR?

I think there is a lot of scope for using VR as the main metaphor. It's about making the Internet easier for people to access, more intuitive in terms of their environment. And why VR? Why not video? Why not some form of alternative "world-visualisation"? Answer: bandwidth. At the end of the day, you ain't gonna stuff broadband content down everybody's phone overnight. With VR, you don't need to send a whole video image down the line. The computer can simulate the scene with a relatively small amount of information about who's moving where and saying what. This has important implications for real-time interaction.

So when did you start to say "this is about linking people – not merely talking to the machine?"

From the earliest times really. In the first databases back in '82, I would have television sets, hi-fi – things like that. Back then, we were just fooling around, but you could see that you could talk to each other and say, "Hi, I'm a robot" – this pathetically stupid wire-frame image strolling around this pathetically stupid world created by half a million pounds worth of computer, which was a lot of money in those days. But you could also immediately see that the object could become a person. Once you caught the concept it was really just a question of time.

Our view here has been to wait until we had the right quality and until we had the right environment. Until we had sites that definitely wanted to be linked up, which was only late last year with the VR cafés in Germany.

There's a move afoot to censor the Internet in the States, heavy handed tactics in the UK...

It'll never happen.

Well, you say that, but The Farm was a big UK-based bulletin board. It was shut down on April 6th for carrying an "adult section".

Really? I think this is an issue of how you set laws and

how you police them. Do you shut down a whole medium because you can't find a way of policing it? The issues about morals, laws and the necessary monitoring of society's interactivity are ones that we all face every day, whether you live in Rwanda or whether you live in the American Mid-West. I've started to call governments and law-makers the Luddites of the Information Revolution, because they can see their power base crumbling. Their political power will become disseminated. I have no geographic disposition whatsoever – I don't care for geographic boundaries. Society will change. We're going through the transition.

People in government don't seem to see that. They don't have that sense at all...

Because they're a generation indisposed to it. None of the younger generation are sitting there saying, "you can't get access to computers and the Net". If politicians would get off their butts and get access to it themselves then they'd understand.

This does bring you to the problem that there are things that we can do in interactive media that are quite beyond the kinds of fictions that human beings have had access to up to now.

Every level of every medium – books, radio, television, computer games and VR – delivers a sensory enhancement. Clearly the stakes get higher. At what level do humans lose the ability to differentiate between what is real and what is not? At what level does the psyche resist the concepts being portrayed? Does it have the ability to extinguish what it knows it shouldn't take onboard? That's the uncharted territory.

Are you still at the stage where you feel that gameplay and character is just a little limited; that the range of options that you can allow the user is still a little limited?

The challenge is *not* to try and replicate anything that in any way resembles a human being. You replicate a construct that is not necessarily too intelligent and build up an expectation of it in the user's mind. If you set the expectations correctly then people don't misinterpret what you're putting in front of them. In that context, we feel that artificial intelligence will provide a level of realism, an "orchestration" of the system, that basically allows you to construct a non-linear storytelling exercise. But time will tell... I mean, why dinosaurs?

Because they're insanely popular with children...?

Nope – because they're pretty dumb. And I think that people will pay to be a Velociraptor... I think what we're trying to do is just put people together in the environment and let their innate qualities of inventiveness and determination take over. We're going to stand back and see what happens.

Is there anything that you would not want to see in virtual reality?

Well, I don't countenance pornography or any other anti-family content in our systems... God, I sound like J Edgar Hoover here. I think it's counter to what Virtuality stands for. I hope we can chart a territory for both encouraging creativity and encouraging others to exploit virtual reality in whatever ways they're interested – it's a medium that's open to everybody.

If we were to tone down *Doom* or your own game *Zone Hunter* to levels that were broadly acceptable 50 years ago, they wouldn't be marketable now, would they?

I don't think *Zone Hunter* is particularly violent. *Doom* is quite violent. But we had a version of *Dactyl Nightmare* called *Capture The Flag* – it was a "secret" version that only aficionados could switch on – it was so totally violent it was untrue. Much worse than *Doom*. We're talking limbs flying, hatcheting people to death amidst screams and blood à la *Monty Python*. We've been there... Even though the characters were obviously cartoons, we still wouldn't release that publicly.

It strikes me that in terms of the public perception of VR, the point at which they look around and see it as something which is not merely about games playing is still a further enormous step forward...

It is, yes. With the first generation, there was only one application – entertainment. It was just good for that. Second generation, I'd say there are four applications: entertainment; situational awareness and training; application development; and marketing. I've always said that – and, sure enough, those are the markets where we are selling. Third generation is where it takes off. Third generation is total immersion. It will involve computing applications that benefit from a simple-to-use human-computer interface... And there'll be quite a few of them.

You've been "immersive" from the outset, yet we're still interacting with computers on a fake "desktop" – even when designing VR. How do you see that changing?

There are a whole variety of technologies that are inextricably linked to the emergence of third-generation VR. Things like eye-slave, peripheral vision, close-coupling in parallel rendering, the whole computation of the view you see. People won't be waving their arms in VR and pulling down menus – they'll be talking. So real-time speech analysis is central to enabling interaction. So much of what we're developing – the "experience" in VR, will evolve through good design. It is such a rich environment.

Thomas Furness at the Human Interface Technology Lab (HIT) is at the prototyping stage with retinal projection technology. What else are you interested in for third or even fourth-generation VR?

Personally I think "write-to-retina" is still a little way off, and will miss third-generation. Often breakthroughs in product development don't come from radical shifts in technology but from significant enhancements in existing technology. So we're comfortable that the technologies exist for our third generation: deformed LCD wide-field display, plus 120-degree, wide-field, eye-slaved devices...

What then do you see as the crucial technologies for VR in the next ten years?

I think the graphics technologies are waning in importance. It's the parallel geometry technology – we need awesome, awesome geometry performance. The days when the question was "will the graphics chip write the pixels quickly enough?" are long gone. The demands that virtual reality places on computer systems and software is an order of magnitude greater than conventional applications. You can only see this when you compare some of the microprocessors that we'll be using, with what the current PC market intends to deliver in the next few years. When Motorola manufacture a chip that clicks up at multiple-Cray levels, then they turn around and say, "what can we go and apply that to? What needs it"? Well there is one application and technology that *does* need it. That's VR. ■ ■ ■

"I think people will pay to be a Velociraptor. We'll just put them in the environment and let their innate qualities of inventiveness and determination take over."

Ivor Benjamin (i.d.benjamin@city.ac.uk) *is a theatre director, systems analyst and is researching a PhD in VR interaction and drama.*

Games Aren't Movies

By Dave Green

There are things in video games that make no fucking sense. In *Asteroids*, right, if your spaceship has such a powerful hyperspace feature, why don't you just hyperspace away from that part of space where all the rocks are? In *Scramble*, in order to get more fuel, you have to blow up the fuel dumps on the ground. How does that work? And in *Killer Instinct*, one of Fulgore's finishing moves is to grow a turret out of the top of his neck and machine-gun his opponent. If he had that ability all along, *why didn't he use it earlier?*

Put a logical flaw like this in a movie and you'd be laughed out of Hollywood. But they're accepted in games because games do not reflect real life. Films always try to reflect reality, so they're not allowed to have characters moving off the top of the screen then reappearing at the bottom – while video games do this all the time. One of the many problems with the *Super Mario Brothers* movie was that Mario's traditional way of dealing with bad guys (jumping on their heads to make them disappear) would, in real life, look utterly ridiculous. In a video game it looks just fine.

Games get away with simplifications that movies never could

Despite these differences, you still hear plenty of well-intentioned hype about "interactive movies" as the Holy Grail of games playing, while games-software companies – Rocket Science, to cite the main offender – rush to sign up top-rated Hollywood talent, like film designer Ron Cobb (who worked on *Alien* and *The Terminator)*. So what's going on?

It's a classic case of new media being hijacked by old. When TV came along, it took people ages to realise it wasn't just radio with pictures. Photographers wasted decades trying to emulate painting. The reasoning now seems to be that, like films, video games make a lot of money. And like films, they take place on a screen. Therefore, they are the same.

This patently isn't true. A film must attempt a plausible, human, emotional premise – it must "make sense" – but many of the best games (*Tempest, Qix, Pacman*) are self-contained, plotless abstractions. When a novel explaining the background scenario falls out of a game box, games players throw it straight in the bin. (Anyone recall the unlikely sci-fi justification for the space-based *Breakout* clone, *Arkanoid*?)

Games can get away with astonishing, imaginative simplifications that movies never could – simplifications which are part of the game's appeal. That's why there hasn't been a film of *Tetris*. ("A chilling Cold War thriller. Sean Connery plays one of those long thin blocks that never turn up when you need one.") Similarly, no-one (yet) feels the need to supply chess boards or draughts sets with more exciting characterisations: "The black king has kidnapped the white king's girlfriend. But the white king vows to win her back in battle…"

Cam Winstanley, editor of controversial games magazine *Amiga Power*, argues that there are films that are like video games, but they're not what you expect: "Martial arts movies and porn videos. In both, the story's only there to further the repetitive, stereotyped action. By itself, the story doesn't stand up at all – it just gets in the way of the good bits."

Video games are a new, exciting medium. Their content is studied in more detail by players than by academics, but they clearly have their own genres, language and grammar. Mario's head-bouncing manoeuvre, for instance, has become an industry standard. It's impossible for this evolving culture not to be influenced by other media, but in the case of cinema – a firmly non-interactive artform that's now over 100 years old – it's equally important that it is not overwhelmed.

A good game puts you in control, it lets you learn the internal logic of a fantastic artificial world. Sometimes effective characterisation and plotting can help achieve this, though mostly they just get in the way. In the final analysis, games don't need to tell any kind of story or even be remotely realistic – they only need to play. Like the captain says at the start of the cult movie, *Dark Star*: "Don't give me any of that intelligent life stuff – just find me something I can blow up."

Dave Green is the Reviews Editor of Wired

And Movies Are Getting IT Wrong, Too

By Scott Rosenberg

A "reclusive systems analyst" accidentally stumbles on a secret program and gets tangled in a murder plot. A "group of young computer buffs" gets framed for a crime and sets out to prove its innocence. A serial killer stalks his victims online.

Look out: the Net movies are coming. These are the high-concept plot lines for three movie projects now underway: Columbia's *The Net*, MGM/UA's *Hackers*, and Disney's *f2f*. And, of course, everyone has a favourite cast in mind for The Kevin Mitnick Story.

But if past experience is any indication, the Net you see on the big screen will only dimly resemble the one Netheads know and love, live and breathe.

The film industry usually operates on an 18 to 24-month lag behind the rest of the media, so the Internet frenzy that began last year won't surface in the movies until later this autumn. And like virtual reality before it, the Internet will suffer a sea change along the way from real life to celluloid. If you're unhappy about the mainstream media's obsession with cyberporn, credit card theft and interactive marketing, wait till you get a load of the Net according to Hollywood.

A moviemaker typically sees a computer and thinks "plot

device." Tiny, powerful and arcane to the average moviegoer, the microchip is the ultimate MacGuffin, the nickname Alfred Hitchcock gave to the object (it hardly mattered what it was) that everyone in a movie was chasing.

This little slip on the keyboard could start a nuclear war *(Wargames)*. This little circuit board could crack any computer security system in the world *(Sneakers)*. This little VR device can turn an idiot into a megalomaniac *(Lawnmower Man)*.

In other words, despite the Internet's trendiness, digital technology – and the informational power it represents in the world – hasn't been explored in movies at all. From hacker adventures like *Wargames* and *Sneakers*, to thrillers like *Clear and Present Danger* and *Disclosure*, to horror stinkers like *Lawnmower Man* and *Brainscan*, Hollywood has presented computers and networks as arenas for the usual kinds of psychokiller plots and paranoid fantasies of gadgetry run amok that we've been seeing for the last 70 years.

The old Frankenstein's monster and sorcerer's apprentice paradigms keep getting recycled. Meanwhile, the world moves on. If the past quarter century has demonstrated anything, it's that the dangers and opportunities inherent in computer technology don't have much to do with the sort of out-of-control, artificially intelligent robots that Hollywood shows seizing power from frail, flesh-and-blood human beings. Instead, both danger and possibility lie in the ability of massively networked systems to hook together weak, breathing human beings everywhere, transforming society in radically new ways that both thrill and scare us – it's a scenario that might make for some visionary movies, as well.

The era of mainframe computing found its ultimate cinematic expression in Stanley Kubrick's *2001*, with HAL 9000, the brainy supercomputer in charge of a spaceship en route to Jupiter. Keeping tabs on his human companions through Cyclopean, red machine-eyes and speaking in unctuously serene tones, HAL embodied the techno fears of the '50s and '60s: infallible computers were going to get bigger and smarter and would develop devious humanoid personalities. Then they'd stop being infallible and turn on us.

HAL was a perfect image of terror when computing meant room-sized IBM irons tended by blue-suited priests. Hal was perhaps most terrifying to audiences because he seemed to have near-human emotions himself and revealed a sort of psychotic despair that somehow we could relate to. Even now, it's eerily touching to hear this computer pleading, serenely but desperately, not to be shut down: "Just what do you think you're doing, Dave? I know everything hasn't been quite right with me. I feel much better now, I really do. Look, Dave, I can see you're really upset about this. I honestly think you ought to sit down calmly, take a stress pill, and think things over." (The trouble was with the crew member's wetware – at least that's the way HAL saw it.)

No movie computer since has matched the resonant originality of HAL. Probably because writers and directors haven't tapped the kind of eerie humanity HAL seemed to have. There have been only forgettably cheesy clones, like the big brain in *Colossus: The Forbin Project* (1970) and versions of PCs that always look a little off, as if an art director decided that an electronic device millions of people use every day needs to be prettier and dumbed-down to be comprehensible. HAL is now more than 25-years-old – in microprocessorland, that's several geological epochs – and Hollywood still hasn't found a credible replacement.

The new Net films aren't likely to change that. A killer using an online account and a password doesn't tell us anything new or interesting; it's just the same old *Dial M for Murder* formula that's been played out in dozens of movies over the last few decades. Only now it's being played out on AOL.

The important issues raised by globally networked computing – information overload, decentralisation, supermobile marketplaces and the destabilisation of governments – haven't registered on Hollywood's radar. Though a superficial awareness of cyberspace and its implications has begun to penetrate the deepest recesses of movieland decision making, the studios remain surprisingly timid about making films that reflect it in any authentic way.

Maybe it's just that no Hollywood insider has been inspired enough to figure out how to incorporate a digital-age perspective into a movie plot. Or maybe the studios are less eager to make movies open to the full complexities of a technological revolution that's transforming their own backyard along with everyone else's. Considering how broadly the new communications landscape is beginning to reshape the movie business, it's remarkable how little these changes have been reflected in what we see on screen. It's as if the studios hope that, if they just pretend that nothing terribly important is going on, they won't have to adjust the end-product or evolve their art.

> Despite the Net's trendiness, technology hasn't been explored in movies at all.

In the next couple of years, we can expect no end of stock movie plots ported into cyberspace: we'll get our fill of romantic triangles and monster capers and slasher stories and teen comedies. Hollywood isn't going to rewrite its whole playbook just because a new medium has emerged. The few writers and directors who do take risks, and dare to explore new ways of reflecting the digital revolution, will probably realise great profits and popular acclaim, because their work will resonate with the truth of a changing age.

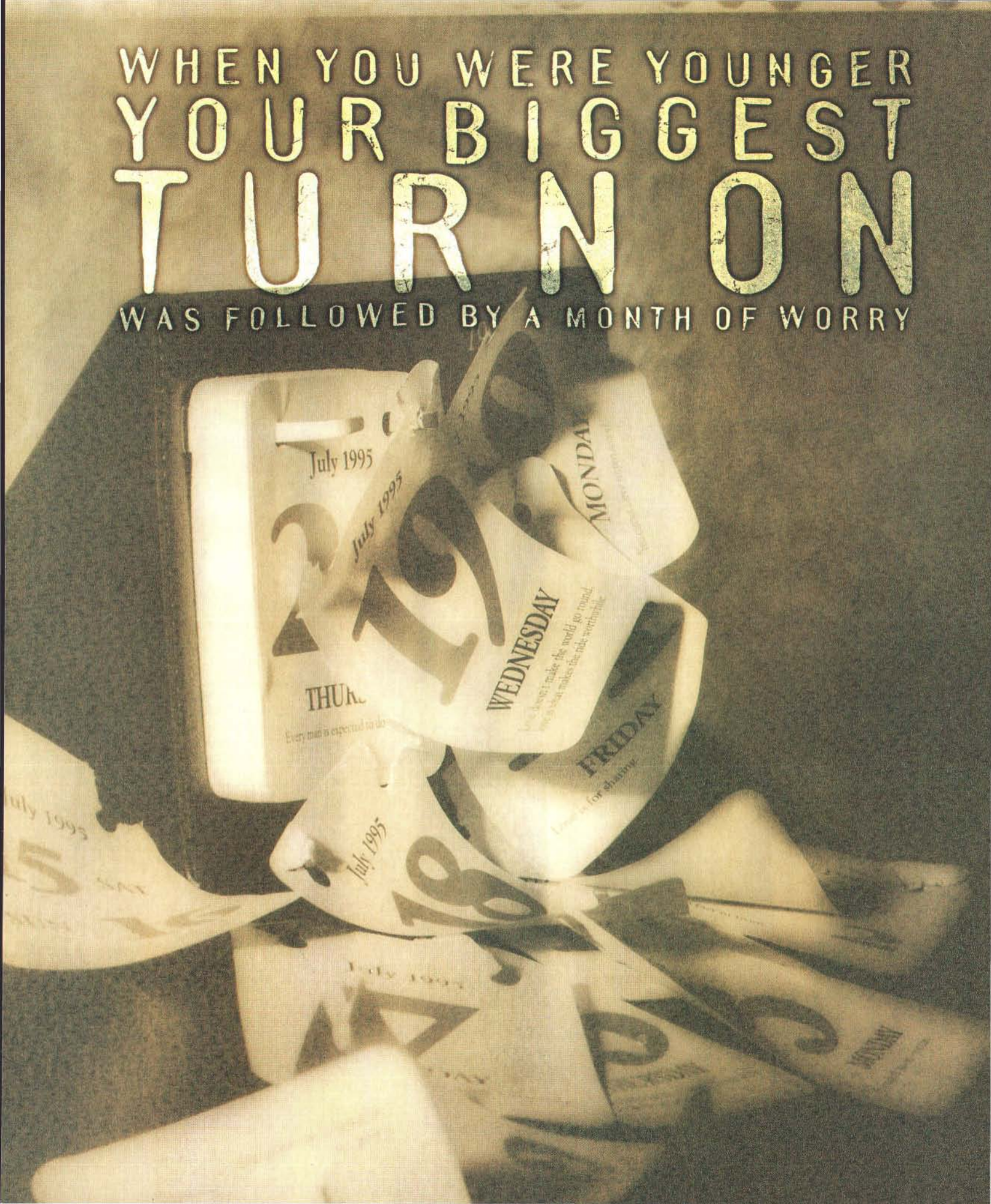
The outlook isn't totally glum. Stanley Kubrick is working on a movie called *AI* for release sometime next holiday season, and his track record is awfully good. And *Johnny Mnemonic* could turn into a big hit.

Mostly, though, we're still waiting for the artists who can capture the experience of networked communications, who can paint Net life in memorable images the way *2001* distilled the early space age or *Citizen Kane* caught the soul of a newspaper baron. Somehow, the digital era must evolve from a Hollywood backdrop into a creative theme. Screen computers must progress from MacGuffin-hood to metaphor. The world is changing – and the movies risk irrelevance unless they capture what those changes mean.

The first film to do so is probably out there already, in the head or on the hard drive of some ambitious writer-director without a credit to his or her name. Is there a young studio exec with the vision to give such a project the green light?

San Francisco Examiner *movie critic Scott Rosenberg* (scottros@well.sf.ca.us) *writes frequently on digital culture.*

WHEN YOU WERE YOUNGER YOUR BIGGEST TURN ON WAS FOLLOWED BY A MONTH OF WORRY



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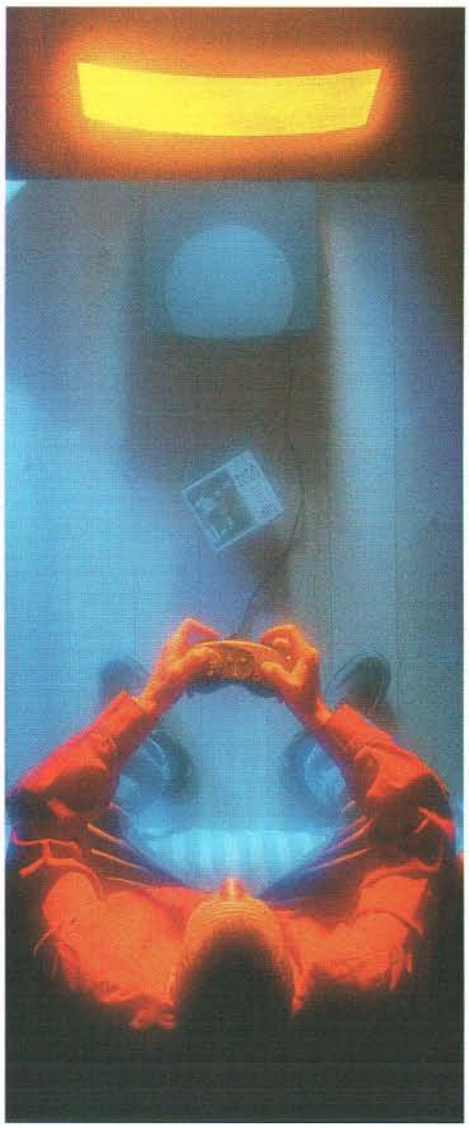

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REVOLUTIONARY EVOLUTIONIST

In the cluttered back room of Richard Dawkins's Oxford flat, a Macintosh morphs through the image of a human skull evolving. Over and over, the huge prognathic jaw shrivels as the cranial cavity swells to grotesquely large proportions: tiny brain, monster brain.

"This is what our skulls might look like in thousands of years," Dawkins remarks, glancing at the screen, "should we be around that long." That same trend applied to Dawkins's own skull produces the image shown on the cover of this magazine.

But even without futuristic morphing, Dawkins's head holds more provocative ideas than most. Two decades ago, Dawkins presented a radical evolutionary perspective in a small book called *The Selfish Gene*, a disturbingly persuasive essay arguing that living things are little more than corporal vessels impelled to heed the primal dictates of selfish genes hell-bent on their own replication and propagation. Much as the English philosopher and novelist Samuel Butler observed a century ago that a chicken is just a way an egg makes another egg, Dawkins proposed that we are nothing but expressions of our selfish genes in the process of making more selfish genes. Taking that idea even further, Dawkins proposed that genes themselves are expressions of particularly elegant code manipulating the world around it to its own reproductive end. He extended these notions into culture and described *ideas* as competing, self-replicating entities he called memes. Dawkins's most recent book, *River Out of Eden* (see excerpt), extends his life's work into a unified evolutionary theory arguing that all life, at its core, is a process of digital-information transfer.

These ideas are intriguing, even a little outrageous, but – most importantly – they have proved astonishingly influential. When a Dawkins meme smacks into your neurons, your neurons obediently repattern themselves around it. You might resist their explicit message, but they are difficult to ignore and impossible to dismiss. They're quite fit – in the Darwinian sense.

Dawkins's revolutionary evolutionary rhetoric has particularly inspired researchers of artificial life. Indeed, Dawkins's work has created new contexts for exploring genetic algorithms and has sensitised the growing community of artificial-life researchers to the evolutionary dynamics of their software creations. Much as Herbert Simon and Marvin Minsky framed the agenda for artificial intelligence, Richard Dawkins has effectively defined the evolutionary agendas for artificial life. If you want to understand the future of natural and synthetic evolution, you have to read Richard Dawkins.

The morphing skulls are just a taste of Dawkins's designs on synthetic evolution. Other randomly selected signs of digital Darwinism are strewn throughout Dawkins's apartment. The seat cushions for the wooden chairs are immaculately embroidered with images of colour biomorphs – polychromatic representations of progeny that Dawkins first bred a decade ago with his own home-brewed artificial-life program. So, don't sit on them. They were lovingly sewn by Lalla Ward – Dawkins's third wife – best known here as Romana, the comely assistant to *Dr Who* but perhaps more proud of her role as Ophelia in a BBC production of *Hamlet*. She

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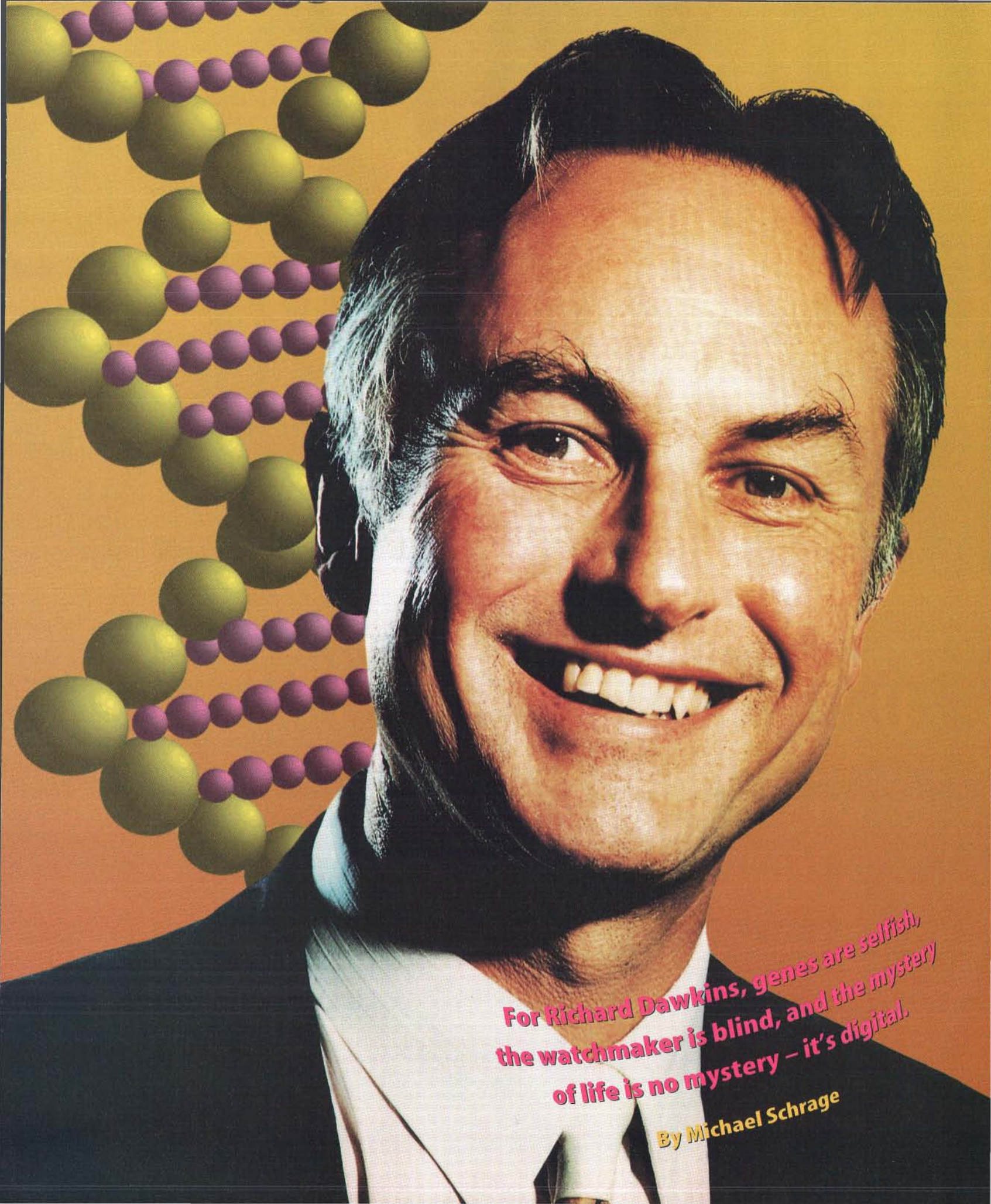
A Media Lab Fellow, Michael Schrage is the author of the newly published No More Teams! – The Dynamics of Creative Collaboration *(Doubleday).*



For Richard Dawkins, genes are selfish, the watchmaker is blind, and the mystery of life is no mystery – it's digital.

By Michael Schrage

and Dawkins were first introduced at a party by Douglas Adams. Small world.

The biomorphs are reminiscent of the musings of D'Arcy Thompson, the British biologist of natural forms. In 1984, completely aware of the innate ability of computers to replicate data patterns, Dawkins decided to play God and write a simple program to generate tree-like structures on his Apple II. He called them biomorphs – living structures. He determined the "fitness" of the image and tried to breed aesthetically charming virtual trees. But the program gave birth to much more than stately elms or magnolias. Dawkins described the excitement of his discovery of synthetic life forms in *The Blind Watchmaker:* "When I wrote this program, I never thought that it would evolve anything more than a variety of tree-like shapes. I had hoped for weeping willows, cedars of Lebanon, Lombardy poplars, seaweeds, perhaps deer antlers. Nothing in my biologist's intuition, nothing in my 20 years experience of programming computers and nothing in my wildest dreams prepared me for what actually emerged on screen. I can't remember exactly when in the sequence it first began to dawn on me that an evolved resemblance to something like an insect was possible. With a wild surmise, I began to breed, generation after generation, from whichever child looked most like an insect. My incredulity grew in parallel with the evolving resemblance... I still cannot conceal from you my feeling of exultation as I first watched these exquisite creatures emerging before my eyes. I distinctly heard the triumphal opening chords of Also Sprach Zarathustra (the *2001* theme) in my mind. I couldn't eat, and that night 'my' insects swarmed behind my eyelids as I tried to sleep."

Perhaps the most amusing pastiche of synthetic biology to grace the Dawkins household is the beautifully carved wooden horses. Most are charming refugees from carnival carousels. A few of the weathered animals go back to the '50s. Are these simply a charming Dawkins eccentricity? Not at all. By sheer happenstance, it turns out, Lalla's mother had been collecting them for decades. Now they're stabled – along with the biomorphs and the simulated skulls – in the Dawkins home. It all seems quite natural. Really.

In the living room, Dawkins picks up a scrapbook and flips through it to read from a letter written to him about *The Blind Watchmaker*, his pop explanation of natural selection. The letter, from a New Zealand academic, reads: "One of my most capable students confessed that she had been reduced to tears by your book. She felt that any religious belief was now impossible to her, as it had been logically disproved."

The academic was kind enough to enclose his reply to the student, which Dawkins reads aloud: "When Lenin travelled through Germany earlier this century, the Germans permitted him only to travel in a sealed, locked train – on the condition that he proceeded nonstop from the one border post to the other. They clearly recognised his persuasiveness and power of his ideas and their capacity to produce unhappiness. I respectfully request that you don't lend Dawkins's book to anybody for the same reasons."

While his tone skids teeteringly close to the brink of smugness, Dawkins never quite makes it over the edge. His is more the pride of craft than ego. The letter writer is, of course, absolutely correct. Dawkins is a dangerous man. Without question, Richard Dawkins is the most brilliant and compelling propagandist of Darwin today. His rhetoric inspires even as it provokes. He is a veritable Tom Paine of evolution, an uncompromising champion of the brute force of natural selection, ruthlessly dismissive of those who question evolution's essential truth. Creationists who believe in the divinity of natural design, of course, might think him more a Goebbels.

But for Dawkins there is nothing left to argue: genes *are* selfish; the watchmaker *is* blind. To say otherwise, he insists, betrays the truth. Cherished concepts like "free will" and "spirituality" live in

THE DIGITAL RIVER

There is a river out of

All organisms that have ever lived – every animal and plant, all bacteria and all fungi, every creeping thing and all readers of these words – can look back at their ancestors and make the following proud claim: Not a single one of our ancestors died in infancy. They all reached adulthood, and every single one successfully copulated. Not a single one of our ancestors was felled by an enemy, or by a virus, or by a misjudged footstep on a cliff edge, before bringing at least one child into the world. Thousands of our ancestors' contemporaries failed in all these respects, but not a single solitary one of our ancestors failed in any of them. These statements are blindingly obvious, yet from them much follows: much that is curious and unexpected, much that explains and much that astonishes.

Since all organisms inherit all their genes from their successful ancestors, all organisms tend to possess successful genes. They have what it takes to become ancestors – and that means to survive and reproduce. This is why organisms tend to inherit genes with a propensity to build a well-designed machine – a body that actively works as if it is striving to become an ancestor. That is why birds are so good at flying, fish so good at swimming, monkeys so good at climbing, viruses so good at spreading. That is why we love life and love sex and love children. It is because we all, without a single exception, inherit all our genes from an unbroken line of successful ancestors. The world becomes full of organisms that have what it takes to become ancestors. That, in a sentence, is Darwinism.

There is a river out of Eden, and it flows through time, not space. It is a river of DNA – a river of information, not a river of bones and tissues: a river of abstract instructions for building bodies, not a river of solid bodies themselves. The information passes through bodies and affects them, but it is not affected by them on its way through.

I speak of a river of genes, but I could equally well speak of a band of good companions marching through geological time. All the genes of one breeding population are, in the long run, companions of each other. In the short run, they sit in individual bodies and are temporarily more intimate companions of the other genes sharing each body. Genes survive down the ages only if they are good at building bodies that are good at living and reproducing in the particular way of life chosen by the species. But there is more to it than this. To be

River Out of Eden ***was published this year by Weidenfeld & Nicolson.***

the dark, helical shadows of our genes. He has roused the ire of England's religious communities by publicly expressing his view that theology is nothing other than a pseudo-intellectual grab bag of charming myths. Dawkins is a fiery evangelist for atheism.

His metaphors, his prose and his ideas burn with a rational passion that simultaneously overwhelms and disarms. He is not a scientist haunted by self-doubt. There are moments in his speech, manner and texts when he comes across as being as completely uncompromising in all of his firmly held beliefs as any Bishop Wilberforce. Even Harvard's well-known evolutionist and Darwin booster, Stephen Jay Gould, is a Darwinian softie by Dawkins's hard standards.

And Dawkins has been extremely effective in probing the boundaries between natural evolution and artificial evolution as created in computers. Indeed, Dawkins's thought suggests that the distinctions between natural evolution and artificial evolution are *themselves* artificial. Evolution is truly transcendental, he argues: Darwin's dynamics are as universal, as profound and as potentially explosive as $E=mc^2$.

This transcendental nature of evolution has bred several new fields of computer science that have a biological feel to them. One of these fields is called computational biology. It focuses on using genetic algorithms and other formulas that imitate genetic breeding for replicating the effects of evolution in ordinary computer chips. The stronger form is artificial life; it attempts to simulate all the essential traits of life – not just evolution – using silicon (and other substrates) instead of carbon. A-life researchers believe life is an information process that can be ported from one matrix to another.

In fact, computational pioneers like Danny Hillis and Stanford University's John Koza now actively explore software that breeds other software. Instead of software engineering as the paradigm of software design, they want to apply Darwin's theories to grow software that grows solutions. The rise of cheap processors and parallel architectures creates the ideal digital ecosystems to spawn software rather than build it. Nature – not rational cognitive planning – becomes the guiding force for the next generation of software solutions.

With his skilful articulation of evolutionary issues – combined with his digital breeding of biomorphs – many researchers consider Dawkins a conceptual godfather of the artificial life movement. He is as comfortable with digital media as with the genetics of fruit flies. He hacks software as readily as he hacks zoology. He wrote his own word processor for the old Apple II and documented the decision processes of baby chicks. With his multimedia, multispecies fluency, Dawkins knows that artificial life has as many insights to offer biology as biology does artificial life.

A shy man with quick movements, Dawkins circles questions warily – almost distrustfully. He is cautious and disciplined. Conversation is not a game. He first pokes at ideas rather than plays with them. He is almost the caricature of the Oxford don – extraordinarily well read with a command of language that moves easily between forcefulness and nuance, with a dry wit that tends toward the droll.

Leon Lederman, the physicist and Nobel laureate, once half-jokingly remarked that the real goal of physics was to come up with an equation that could explain the universe but still be small enough to fit on a T-shirt. In that spirit, Dawkins offered up his own T-shirt slogan for the ongoing evolution revolution: LIFE RESULTS FROM THE NON-RANDOM SURVIVAL OF RANDOMLY VARYING REPLICATORS. Expect to see it on student T-shirts everywhere from Oxford and MIT to the Santa Fe Institute.

Although whimsically done, Dawkins's T-shirt slogan is at the centre of his powerful manifesto. The message nattily packages the essential insight that makes Dawkins far more than just an evolutionary propagandist and provocateur. In many ways, what 104 ►

Eden, and it flows through time, not space. It is a river of DNA, a river of information. An excerpt from Richard Dawkins's new book.

good at surviving, a gene must be good at working with the other genes in the same species – the same river. To survive in the long run, a gene must be a good companion. It must do well in the company of, or against the background of, the other genes in the same river. Genes of another species are in a different river.

The feature that defines a species is that all members of any one species have the same river of genes flowing through them, and all the genes in a species have to be prepared to be good companions of one another. A new species comes into existence when an existing species divides into two. The river of genes forks in time. From a gene's point of view, speciation, the origin of new species, is "the long goodbye". After a brief period of partial separation, the two rivers go their separate ways forever, or until one or the other dries extinct into the sand. Secure within the banks of either river, the water is mixed and remixed by sexual recombination. But water never leaps its banks to contaminate the other river. After a species has divided, the two sets of genes are no longer companions. They no longer meet in the same bodies, and they are no longer required to get on well.

There are now perhaps 30 million branches to the river of DNA, for that is an estimate of the number of species on earth. It has also been estimated that the surviving species constitute about one per cent of the species that have ever lived. It follows that there have been some three billion branches to the river of DNA altogether. Today's 30 million branch rivers are irrevocably separate. Many of them are destined to wither into nothing, for most species become extinct. If you follow the 30 million rivers back into the past, you will find that, one by one, they join up with other rivers. The river of human genes unites with those leading to other major groups of mammals: rodents, cats, bats, elephants. After that, we meet the streams leading to various kinds of reptiles: birds, amphibians, fish, invertebrates.

Francis Crick and James Watson, the unravellers of the molecular structure of the gene, should be honoured for as many centuries as Aristotle and Plato. Their Nobel Prizes were awarded "in physiology or medicine", but this is almost trivial. Our whole understanding of life has been revolutionised as a direct result of the ideas that those two young men put forward in 1953. Ever since Watson-Crick, molecular biology has become digital.

Watson and Crick enabled us to see that genes themselves, within their minute internal structure, are long strings of pure digital information. 106 ►

Just van Rossum
and Erik van Blokland
would be rich and famous
LettError™
if everyone who used their typefaces
paid for them.
By Erik Spiekermann

Wired: You made the first "random" typeface, called Beowulf, by replacing the commands "lineto" and "curveto" in the PostScript code with your own command "freakto". The new command calls up a random generator that makes the character outlines irregular. When you created Beowulf, were you trying to prove something, or was it just a joke?

van Blokland: It was quite a joke. We were both into programming – or would you call it hacking? What came of that interest was a very cool-looking thing. We wanted to make a typeface that looked very smooth and rounded off, but instead it became spiky, with little pointy bits sticking out from the edges of each character in a most unpredictable way. And what's the most fun about Beowulf is that every time you print it, those spiky bits take on a slightly different appearance.

You both have said that a designer, by definition, has to make things that haven't been made before. But why? Isn't it the job of the designer to work within a frame of reference which is commonly understood? If we use Egyptian hieroglyphs or Chinese writing here in The Hague, we won't communicate anything. But at the same time, as graphic designers who are trying to innovate and establish creative new ways of communicating, we have to be surprising and invent new images. What does that mean for type? Is it going to disappear or is it going to go back to images?

van Rossum: Type is definitely here to stay. Text won't disappear; in fact, you'll see more and more of it on screens. Images simply aren't strong enough or powerful enough to express everything you want to say. You can't make pictures to replace this interview.

How did Trixie happen? Wasn't it named after the typewriter you took it from?

van Blokland: On the way back from a type conference in 1990, we came up with two ideas for typefaces: we could digitise handwriting and we could use a dirty typewriter. Not long after that, we came up with JustLeftHand and ErikRightHand, which are simply scans of our respective handwriting. Trixie took a bit longer. We found an old typewriter (named Trixie), simply printed out all the characters and then scanned them into our computers. But leaving all the dirt and irregularities in caused problems when we got to production. There were too many points on the outlines, making the files very large and the fonts almost impossible to print.

How about the other fonts you designed, the instant types – from rubber stamps, Dymo tape (embossed label tape), stencil letters and other stuff you found in your attic and then you decided to use. That sounds a lot like marketing: "Let's do something trendy!"

van Rossum: It involved a bit more marketing than Trixie, which was modelled after the only type in people's homes – the typewriter – with its uneven ribbon, filled-in letters and the occasional character that jumped up or down. But in the beginning, there wasn't any marketing idea. I saw this thing and thought, let's make a typeface out of it. Then we decided we needed a complete package, a family of faces. I had a set of rubber stamps I used to play with, and my dad had given me these stencil letters that he used for his architectural drawings. And then someone from FontShop came up with the originals for Karton – letters stamped onto the cardboard boxes from Apple. Everybody recognised the letters, but nobody considered it type. It's always just existed; nobody ever designed it. Now, people like Karton because it looks so ordinary, so modest. It's quite cool to have stuff on your computer that feels so familiar, unlike all that computer-looking bitmap stuff.

This was a hot phase in your life. First, you had a random font that played havoc with its own shape, then your own handwriting, almost unchanged. ErikRightHand and JustLeftHand have become incredibly popular because they happen to be good Dutch handwriting, not calligraphic. They look like the sort of handwriting everybody would like to have if they practiced and could write beautifully. And Trixie, the typewriter face, is the ultimate vernacular. People everywhere still recognise it, although typewriters hardly exist anymore.

Everybody still wants to be the first kid on the block to use a new font and when you created Trixie lots of designers rushed to use it. What happens then? Does it become mainstream? Does that kill it?

van Rossum: Trixie is mainstream now, and in fact it's so mainstream that we can't stand it anymore. It's been around for at least three years. In Europe, almost all the hip cultural magazines use it when they want to express something that's brand-new, urgent, factual. In the US, it's been used by *Rolling Stone* and a lot of trendy local publications. When you're a type designer and you find your own typeface somewhere for the first time, it's a nice feeling. It's maybe a little like being a rock star, hearing your song for the first time on the radio. But it's a small and quiet pleasure. Nobody knows. And you know that you couldn't explain it to your friends even if you wanted to. I'm sure that even Sting doesn't know my handwriting is on his album cover.

Can you become famous and rich as type designers?

van Blokland: We would be rich if everybody who uses our typefaces paid for them.

Before the advent of desktop publishing and type-design tools, drawing a typeface could take a few years. It was expensive, time-consuming and boring. But these days, type design is much more accessible. Should every graphic designer have to learn to design typefaces or at least manipulate fonts?

van Blokland: Yes. I call it type *tuning*. Type is a commodity, a thing that everybody can change. These days, if a designer doesn't like a typeface, it doesn't take long to go into it and change the kerning or the width or the shape of a character. We certainly have the technology, so there's no excuse to put up with bad type. ■ ■ ■

Erik Spiekermann, who designed the beautiful and practical Meta typeface, began experimenting with type at the age of 12. He now runs a German design firm, MetaDesign.

Just van Rossum and Erik van Blokland make up the formidable typographic duo LettError. They both came out of the Royal Academy of Fine and Applied Arts in The Hague, the educational institution in the Dutch capital that turns out typeface designers. Both in their mid-twenties, they have already come a long way professionally. After working at MetaDesign in Berlin for a few years when they were fresh from the academy, they spent time at David Berlow's The Font Bureau Inc in Boston, Adobe Systems in Mountain View, California, and many other type shops. Not always together, but constantly in touch, they have jointly designed typefaces, written programs, created onscreen movies, performed at conferences and generally made themselves known among font mongers, online freaks and ResEdit hackers. *Wired* sent Erik Spiekermann to meet the two and suss out their take on typography today.

FLORIS LEEUWENBERG/TCS

TECHNOPAG

MAY THE ASTRAL

BY ERIK DAVIS

ANS
PLANE BE REBORN IN CYBERSPACE.

Mark Pesce is in all ways wired. Intensely animated and severely caffeinated, with a shaved scalp and thick black glasses, he looks every bit the hip Bay Area technonerd. Having worked in communications for more than a decade, Pesce read William Gibson's breathtaking description of cyberspace as a call to arms, and he's spent the last handful of years bringing *Neuromancer*'s consensual hallucination to life – concocting network technologies, inventing virtual-reality gadgets, tweaking the World Wide Web. Long driven to hypermedia environments, the MIT dropout has now designed a way to "perceptualise the Internet" by transforming the Web into a three-dimensional realm navigable by our budding virtual bodies.

Pesce is also a technopagan, a participant in a small but vital subculture of digital savants who keep one foot in the emerging technosphere and one foot in the wild and woolly world of Paganism. Several decades old, Paganism is an anarchic, earthy, celebratory spiritual movement that attempts to reboot the magic, myths and gods of Europe's pre-Christian people. Pagans come in many flavours – goddess-worshippers, ceremonial magicians, witches, Radical Fairies. Though hard figures are difficult to find, estimates generally peg their numbers in the US at 100,000 to 300,000. They are almost exclusively white and drawn from bohemian and middle-class enclaves.

A startling number of Pagans work and play in technical fields, as sysops, computer programmers and network engineers. On the surface, technopagans like Pesce embody quite a contradiction: they are Dionysian nature worshippers who embrace the Apollonian artifice of logical machines. But Pagans are also magic users and they know that the Western magical tradition has more to give a wired world than the occasional product name or the background material for yet another hack-and-slash game. Magic is the science of the imagination, the art of engineering consciousness and discovering the virtual forces that connect the body-mind with the physical world. And technopagans suspect that these occult Old Ways can provide some handy tools and tactics in our dizzying digital environment of intelligent agents, visual databases and online MUDs and MOOs.

"Both cyberspace and magical space are purely manifest in the imagination," Pesce says as he sips java at a crêperie in San Francisco's Mission district. "Both spaces are entirely constructed by your thoughts and beliefs."

PAGANS LIKE TO DO THINGS – TO MAKE MEAD, TO PUBLISH ZINES, TO WIELD SWORDS DURING GATHERINGS OF THE SOCIETY FOR CREATIVE ANACHRONISM. AND MANY LIKE TO HACK CODE.

"WITHOUT THE SACRED THERE IS NO DIFFERENTIATION IN SPACE. IF WE ARE ABOUT TO ENTER CYBERSPACE, THE FIRST THING WE HAVE TO DO IS PLANT THE DIVINE IN IT."

– MARK PESCE

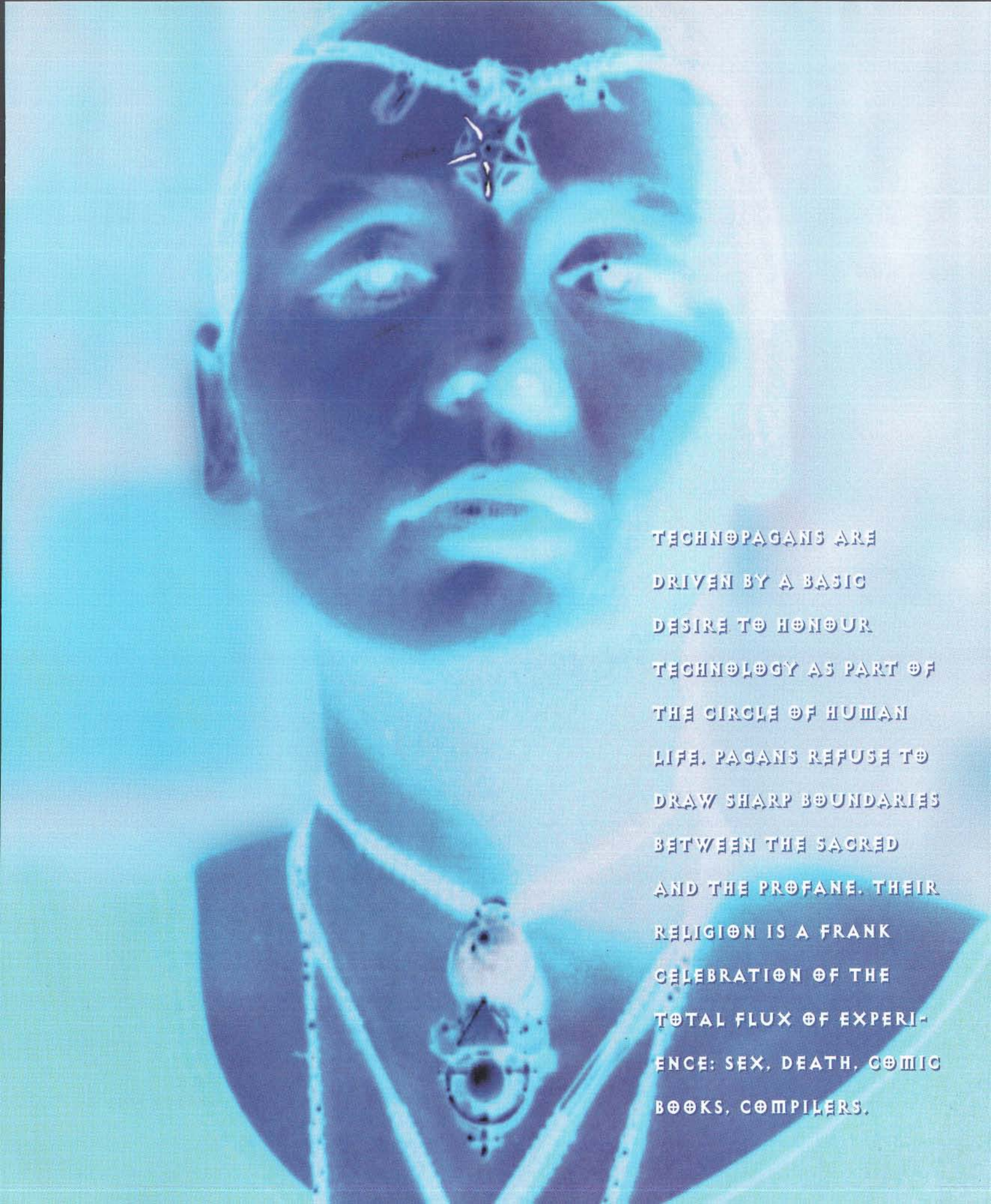
In a sense, humanity has always lived within imaginative interfaces – at least from the moment the first Palaeolithic grunt looked at a mountain or a beast and saw a god peering back. Over the millennia, alchemists, Kabbalists and esoteric Christians developed a rich storehouse of mental tools, visual data spaces and virtual maps. It's no accident that these "hermetic" arts are named after Hermes, the Greek trickster god of messages and information. One clearly relevant hermetic technique is the art of memory, first used by ancient orators and rediscovered by magicians and Jesuits during the Renaissance. In this mnemonic technique, you construct a clearly defined building within your imagination and then place information behind an array of colourful symbolic icons – by then "walking through" your interior world, you can recover a storehouse of knowledge.

The Emerald Tablet of Hermes Trismegistus gives perhaps the most famous hermetic maxim: "As above, so below". According to this ancient Egyptian notion, the cosmos is a vast and resonating web of living symbolic correspondences between humans and earth and heaven. And as Pesce points out, this maxim also points to a dynamite way to manipulate data space. "You can manipulate a whole bunch of things with one symbol, dragging in a whole idea space with one icon. It's like a nice compression algorithm."

Besides whatever technical inspiration they can draw from magical lore, technopagans are driven by an even more basic desire: to honour technology as part of the circle of human life, a life that for Pagans is already divine. Pagans refuse to draw sharp boundaries between the sacred and the profane, and their religion is a frank celebration of the total flux of experience: sex, death, comic books, compilers. Even the goofier rites of technopaganism (and there are plenty) represent a passionate attempt to influence the course of our digital future – and human evolution. "Computers are simply mirrors," Pesce says. "There's nothing in them that we didn't put there. If computers are viewed as evil and dehumanising, then we made them that way. I think computers can be as sacred as we are, because they can embody our communication with each other and with the entities – the divine parts of ourselves – that we invoke in that space."

Erik Davis (saucer@netcom.com) *writes about culture, technology and the intersection of the two for the* Village Voice *and other publications.*

MAIN PICTURE: REX FEATURES; THIS PAGE: MAGNUM



TECHNOPAGANS ARE DRIVEN BY A BASIC DESIRE TO HONOUR TECHNOLOGY AS PART OF THE CIRCLE OF HUMAN LIFE. PAGANS REFUSE TO DRAW SHARP BOUNDARIES BETWEEN THE SACRED AND THE PROFANE. THEIR RELIGION IS A FRANK CELEBRATION OF THE TOTAL FLUX OF EXPERIENCE: SEX, DEATH, COMIC BOOKS, COMPILERS.

PAGANS ARE ULTIMATELY QUITE SERIOUS, BUT MOST PRACTISE THEIR RELIGION WITH A DISARMING HUMOUR AND A WILLINGLY CHILDLIKE SENSE OF PLAY. THE RITUAL DRUMMER FOR THE EVENING HOLDS OUT A READ-WRITE ARM OF A 20MBYTE HARD DISK. "AN ANCIENT TOOL OF SORCERY," HE SAYS IN THE SAME GOOFBALL TONE YOU HEAR AT COMIC-BOOK CONVENTIONS.

If you hang around the San Francisco Bay area or the Internet fringe for long, you'll hear loads of loopy talk about computers and consciousness. Because the issues of interface design, network psychology and virtual reality are so open-ended and novel, the people who hack this conceptual edge often sound as much like science fiction acidheads as they do sober programmers. In this vague realm of gurus and visionaries, technopagan ideas about "myth" and "magic" often signify dangerously murky waters.

But Pesce is no snake-vapour salesperson or glib New Ager. Sure, he spends his time practising kundalini yoga, boning up on Aleister Crowley's Thelemic magic and tapping away at his book *Understanding Media: The End of Man*, which argues that magic will play a key role in combating the virulent information memes and pathological virtual worlds that will plague the coming cyberworld. But he's also the creator of VRML, a technical standard for creating navigable, hyperlinked 3-D spaces on the World Wide Web. VRML has been endorsed by Silicon Graphics, Netscape, Digital, NEC and other Net behemoths, and Pesce's collaborator, Tony Parisi at Intervista Software, will soon release a 3-D graphical Web browser called WorldView, which will add a crucial spatial dimension to the Web's tangled 2-D hyperspace of home pages, links and endless URLs. As Pesce's technomagical children, WorldView and VRML may well end up catalysing the next phase of online mutation: the construction of a true, straight-out-of-*Neuromancer* cyberspace on the Internet.

WorldView first popped out of the ether four years ago, when Pesce was sitting around pondering a technical conundrum: how do you know what's where in cyberspace? "In the physical world, if you want to know what's behind you, you just turn around and look," he explains. "In the virtual reality of cyberspace, you'd do the same thing. But what is the computing equipment involved in the network actually doing? How do I distribute that perceptualisation so that all the components create it together and no one part is totally dominant?"

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ROWLEY WHIPS OUT A VIKING HORN BRIMMING WITH HOMEMADE FULL-MOON MEAD. "PLANT THE NET IN THE EARTH," SAYS A PROGRAMMER.

Then Pesce was struck with a vision. In his mind's eye, he saw a web, and each part of the web reflected every other part. Like any good wirehead, he began to code his numinous flash into a software algorithm so his vision could come to life. "It turns out that the appropriate methodology is very close to the computer equivalent of holography, in which every part is a fragment that represents the greater whole." Using a kind of a six-degrees-of-separation principle, Pesce invented a spatial cyberspace protocol for the Net.

It was only later that someone told him about the mythical net of Indra. According to Chinese Buddhist sages, the great Hindu god Indra holds in his possession a net stretching into infinity in all directions. A magnificent jewel is lodged in each eye of the net and each jewel reflects the infinity of other jewels. "It's weird to have a mystical experience that's more a software algorithm than anything else," Pesce says with a grin. "But Friedrich Kekulé figured out the benzene ring when he dreamed of a snake eating its tail."

Of course, Pesce was blown away when he first saw Mosaic, NCSA's powerful World Wide Web browser. "I entered an epiphany I haven't exited yet." He saw the Web as the first emergent property of the Internet. "It's displaying all the requisite qualities – it came on very suddenly, it happened everywhere simultaneously, and it's self-organising. I call that the Web eating the Net." Driven by the dream of an online data-storage system that's easy for humans to grok, Pesce created VRML, a "virtual-reality markup language" that adds another dimension to the Web's HTML, or hypertext markup language. Bringing in Rendermorphics Ltd's powerful but relatively undemanding Reality Lab rendering software, Pesce and fellow magician Parisi created WorldView, which hooks onto VRML the way Mosaic interfaces with HTML. As in virtual reality, WorldView gives you the ability to wander

COLORIFICI; REX FEATURES

and poke about a graphic Web-site from many angles.

Pesce now spreads the word of cyberspace in conference halls and boardrooms across the land. His evangelical zeal is no accident – raised a hard-core Catholic and infected briefly with the mighty Pentecostal Christian meme in his early 20s, Pesce has long known the gnostic fire of passionate belief. But after moving to San Francisco from New England, the contradictions between Christian fundamentalism and his homosexuality became overwhelming. At the same time, odd synchronicities kept popping up in ways that Pesce could not explain rationally. Walking down the street one day, he just stopped in his tracks. "I thought, OK, I'm going to stop fighting it. I'm a witch."

For Pesce, the Craft is nothing less than applied cybernetics. "It's understanding how the information flow works in human beings and in the world around them, and then learning enough about that flow that you can start to move in it, and move it as well." Now he's trying to move that flow online. "Without the sacred there is no differentiation in space; everything is flat and grey. If we are about to enter cyberspace, the first thing we have to do is plant the divine in it."

And so, a few days before Halloween, a small crowd of multimedia students, business folk and Net neophytes wander into Joe's Digital Diner, a technoculture performance space located in San Francisco's Mission district. The audience has come to learn about the World Wide Web, but what they're going to get is CyberSamhain, Mark Pesce's digitally enhanced version of the ancient Celtic celebration of the dead known to the rest of us as Halloween. Of all of Paganism's seasonal festivals, Samhain (pronounced "saw-when") is the ripest time for magic. As most Pagans will tell you, it's the time when the veils between the worlds of the living and the dead are thinnest. For Pesce, Samhain is the perfect time to ritually bless WorldView as a passageway between the meat world and the electronic shadow land of the Net.

Owen Rowley, a buzz-cut fortysomething with a skull-print tie and devilish red goatee, sits before a PC, picking though a Virtual Tarot CD-ROM. Rowley's an elder in Pesce's Silver Star witchcraft coven and a former systems administrator at Autodesk. He hands out business cards to the audience as people take in the room's curious array of pumpkins, swords and fetish-laden computer monitors. Rowley's cards read: Get Out of HELL Free. "Never know when they might come in handy," Rowley says with a wink and a grin.

To outsiders (or "mundanes", as Pagans call them), the ritual world of Pagandom can seem like a strange combination of fairy-tale poetry, high-school theatrics and a New Age Renaissance Fayre. And tonight's crowd does appear puzzled. Are these guys serious? Are they crazy? Is this art? Pagans are ultimately quite serious, but most practise their religion with a disarming humour and a willingly childlike sense of play. Tonight's techno-pagans are no different. The ritual drummer for the evening, a wiry, freelance PC maven, walked up to me holding the read-write arm of a 20Mbyte hard disk. "An ancient tool of sorcery," he said in the same goofball tone you hear at comic-book conventions and college chemistry labs. Then he showed me a real magic tool, a beautiful piece of live wood he obtained from a tree shaman in Britain and which he called a "psychic screwdriver".

With the audience temporarily shuttled next door for a World Wide Web demo, Pesce gathers the crew of mostly gay men into a circle. (As Rowley says, "in the San Francisco queer community, Paganism is the default religion.") In his black sports coat, slacks and red Converse sneakers, Pesce seems an unlikely mage. Then Rowley calls for a toast and whips out a Viking horn brimming with homemade full-moon mead.

Pagandom can seem like a combination of fairy-tale poetry, high-school theatrics and New Age Renaissance Fayre.

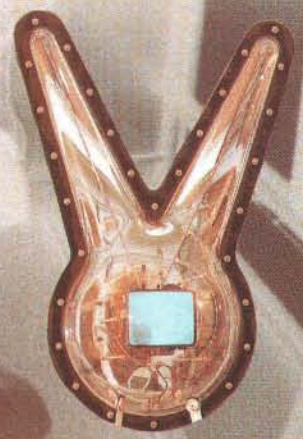
"May the astral plane be reborn in cyberspace," proclaims a tall sysop in a robe before sipping the heady honey wine.

"Plant the Net in the Earth," says a freelance programmer, passing the horn to his left.

"And to Dr Strange, who started it all," Rowley says, toasting the Marvel Comics character before chuckling and draining the brew.

As the crowd shuffles back into the room, Pesce nervously scratches his head. "It's time to take the training wheels off my wand," he tells me as he prepares to cast this circle.

At once temple and laboratory, Pagan circles make room for magic and the gods 107►

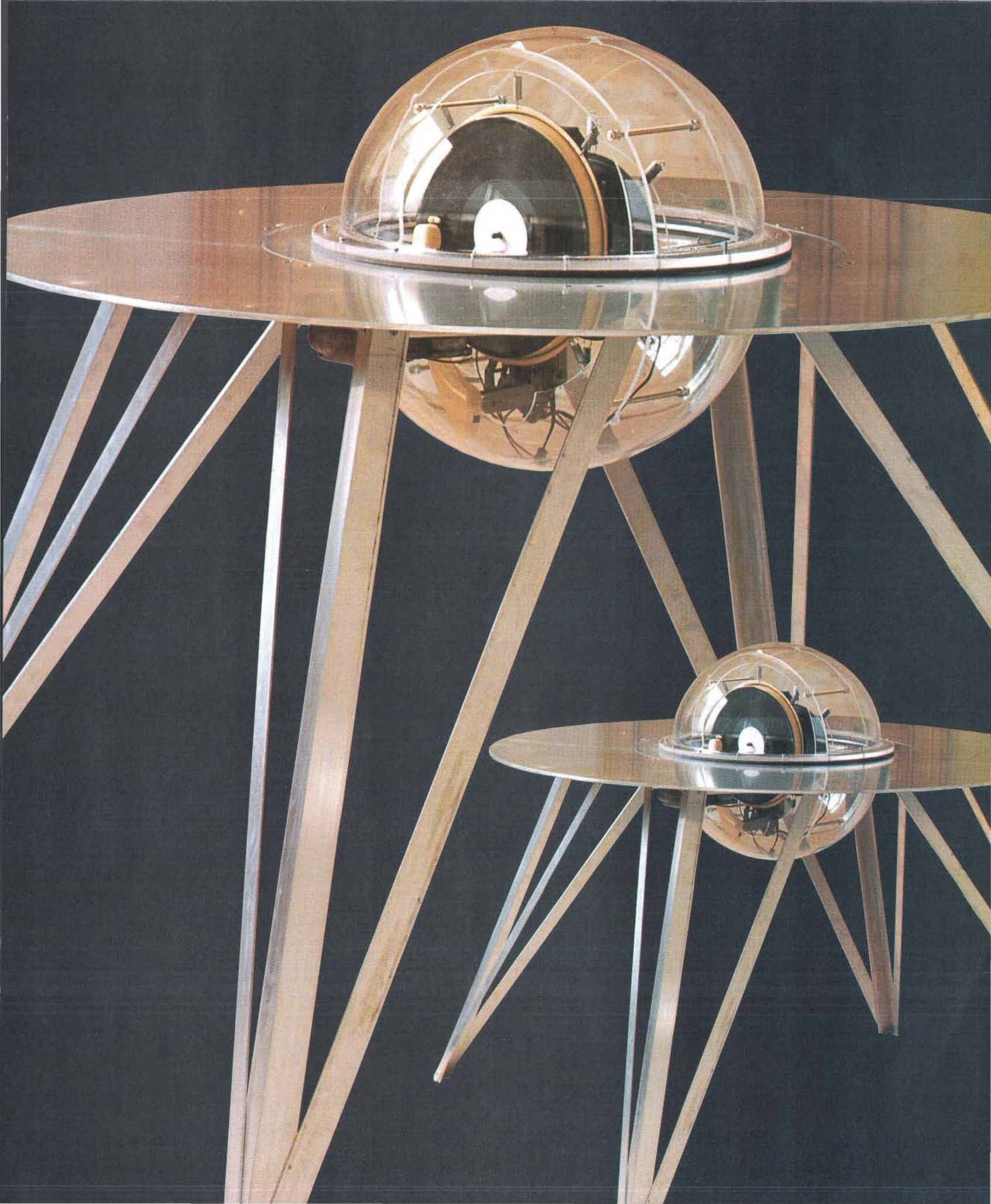


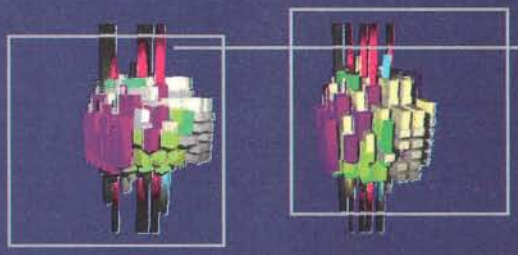
Obscurer Cameras

Forget the digital camera. Steven Pippin, one of the art world's greatest Heath Robinsons, makes his photographs from almost anything. His first camera was made from a Coronation biscuit tin. Then he emptied a wardrobe and used it as a camera to photograph its piled-up contents. "I have become fascinated with the idea of constructing a camera whose viewpoint is not some external subject," says Pippin, "but instead looks back in on itself towards its own darkness."

Hence Pippin's conversion of a toilet on a London-to-Brighton train (using a specially designed aluminium "insert" fitted into the toilet bowl). Other transformational cameras include a caravan, an industrial washing machine and a TV.

More recently, Pippin has turned to universal machines such as his "Cosmos" (see right). At the centre of this work is a 10-inch vinyl recording of Albert Einstein explaining his Theory of Relativity, and it's based on the planetary models made by Renaissance scientists. As with all of Pippin's work, the past infects art, which reminds us of technology's Janus-like perspective. – *Brian Find*.





The object that appeared on the screen was a long way from anything most people would recognise as architecture. Without doors, windows or anything else one would associate with a building, it hung frozen in its 3-D grid like an exhibit in some museum of alien natural history. But the Interactivator is among the first-born of a new discipline – evolutionary architecture. Nobody will ever build a structure so grotesque, so impractical, but architects have much to learn from the process of its creation.

The Interactivator posits that someday, probably someday soon, architects might wish to design a building in much the same way as nature designed a snail's shell: by trying out millions of possibilities and discarding all but the few which are suited to the environment in which they are to function. True, evolutionary architecture relies on only the simulation of sun, rain and wind, and is created in the non-world of a powerful computer. But the computer can try out more snail shells – or buildings – in a few seconds than nature can manage in a century. Tapping into that fecundity may enable designers to perform unexpected marriages of the practical and the unimaginable. It may also fundamentally change the nature of design itself – from creating to curating.

The Interactivator is an experiment which enables anybody with Netscape to try their hand at evolving a shape. As the product of the tinkerings and modifications of a thousand passing surfers, it is little wonder that the Interactivator looks so weird. It can be found on a labyrinthine Web-site created by Jonathan Moberly and Tom Neville. Together they form Ellipsis, Britain's most innovative architectural publishers. But its creator is Professor John Frazer, architectural theoretician, CAD guru, professor in the faculty of Art and Design at the University of Ulster and head of a teaching unit at the Architectural Association (AA) researching morpho-genetic processes. More importantly, he is a man whose self-appointed mission is to bring evolution into the centre of the discipline of design.

Frazer lives and works on a yacht designed by Philippe Starck, sharing the space with his wife Julia, also an architect, and a collection of antique typewriters. But it is the Architectural Association bar that seems like his natural habitat. Around us, knots of fashionable young people pore over blueprints. Slides are being projected on one wall, and above our heads a monitor plays a tape of a bizarre CAD walkthrough that resembles the visuals at Megatripolis. It's worth remembering that Prince Charles once called this place "Frankenstein's Academy". Frazer's wish to give life to inanimate buildings seems eerily similar to the Baron's experiments. Maybe Charles got it right after all.

The computer's cornucopia

Evolving architectural designs may be a way, says Frazer, "of harnessing the full profligacy of natural creation." Architecture, he claims, is on the brink of a revolution which will transform it beyond all recognition. The architect will no longer be required to foresee every contingency or calculate every technical requirement of a design. In partnership with the computer, he or she will simply direct the evolution of an idea, steering it in fruitful directions and taking advantage of the variations thrown up in the process.

Hari Kunzru (hari@juju.demon.co.uk) *is a London-based freelance writer with interests in art, technology and culture. Jess Search* (jess@soul-pp.demon.co.uk) *is a journalist and television researcher.*
The Interactivator is at the Ellipsis site – http://www.gold.net/ellipsis/
John Frazer's (100415.1704@compuserve.com) An Evolutionary Architecture *is published by the Architectural Association.*

architects

Darwin found a simple rule underlying the design of finches. John Frazer applies it to architecture. It's called survival of the fittest.

By Hari Kunzru and Jess Search

# of change

Although the new techniques have yet to be used to produce finished buildings, they are already being used in the design of industrial components such as turbines. The mathematical engine driving all these developments is the genetic algorithm (GA). GAs are nothing less than computerised versions of Darwinian evolution, incorporating ideas of natural selection and genetic variation. Chromosomes are represented by bit strings, with individual bits representing genes. A genetic programme runs by generating a population of digital creatures, assigning each one a numerical "fitness value", some criterion for evolutionary success or failure. In the case of a turbine design, a "fit" individual might represent some aspect of the form which makes it more aerodynamic. GAs are especially useful for such problems because data about fluid flow, resistance and so on can be fed into the simulation, making it easy to define what constitutes evolutionary success and failure. The computer is instructed to make multiple copies of higher fitness individuals, eliminating the unfit. Genetic operations such as mutation (flipping individual bits) and crossover (exchanging substrings of two parents to form two offspring) are then applied to create a second generation, some of whom will differ in unexpected ways from their 'parents'. This procedure is repeated again and again, gradually producing a population of digital creatures adapted to the task in hand. On the screen, the turbine designer sees a series of forms which culminate in the one with the least drag.

The future is a new form of designed artefact interacting and evolving

Technology without terror

Frazer's own experiments at combining computer modelling with architectural design began in Cambridge in the 1960s. He found himself sharing late-night computer time with John Conway, inventor of The Game of Life. Maybe there was some memetic cross-fertilisation between the guru of A-Life and the young architect tinkering with form generation. Certainly Frazer has gone on to do sophisticated work with cellular automata, declaring that his work should be considered as a form of artificial intelligence. His Cambridge experience confirmed to him that computers were the way forward to alternative ways of creating architecture.

Since Conway and Frazer shared computer time in Cambridge, the discovery that structures of incredible complexity could be generated by the repeated application of simple instructions has led to the disciplines known as non-linear dynamics and chaos theory. Today scientists of all persuasions are mining these fields for ideas. The concepts of emergent global order, spontaneous form generation and so on are now making their way into the cultural mainstream.

Yet when Frazer and Conway were sitting up late in the Cambridge computer centre, watching their results inching out of the graph plotter, their activities were considered marginal, even eccentric. In the computer world, systems scientists were then fixated by the idea of rigid top-down control; in architecture, the Modernists who dominated British architecture with their severe, functional structures were far from amenable to the ideas taking shape after dark in the Cambridge lab.

Given his background, it was perhaps inevitable that Frazer would eventually turn to genetic algorithms in his search for an evolutionary architecture. One avenue of exploration was "intelligent modelling" which, in essence, involves embedding chips and sensors into building blocks. The designer works in 3-D and his modelling kit keeps examining the positions of its various parts. It transmits a constantly changing record of its state to a computer, which then converts it into a CAD document.

Frazer's experimentation with 3-D modelling sprang from dissatisfaction with the limitations of two-dimensional design tools – be they pencil and paper or screen and mouse. As time went on, the inadequacy of existing design programs spurred him to further conceptual leaps. "As an interface, a computer terminal is so … two-dimensional," he says. And to accuse someone of "two-dimensional thinking" is the architect's insult par excellence. (Frazer has, for example, been known to dismiss graphic designers as "flatheads".)

Frazer has always advocated creatives getting stuck into the "hard" technical side of computer-aided work. Today, he encourages his students at the Architectural Association to construct their own software components, from light-sensors to fully-blown neural nets. "Once you've built your own computer, technology holds no more terror," he smiles.

It's an attitude that can be traced back to the 1970s, when Frazer's company, Autographics, created design software at the intellectual forefront of the revolution in computer-aided design. Ironically, the programs he produced at this time would form the blueprint for future commercial success – albeit in the hands of other companies.

Frazer introduced evolutionary modelling to his research groups at Ulster and at the AA, with the aim of solving relatively simple architectural problems. One early test of the application involved evolving columns to fit the rules of proportion laid down by James Gibbs in the 18th century. "Unless we told it to select for other things," Frazer recalls, "the programme took just a few seconds to converge on a perfectly proportioned Gibbsian Tuscan column." With evidence that genetic algorithms could work, they went on to look at the design of racing yacht hulls – something close to Frazer's heart. Using complex calculations concerning displacement, hull area, waterplane and so on, they bred a series of increasingly high-performance hull designs.

At one level, both columns and hulls can be approached in the same way as turbine design. Success or failure is easily measurable: the column either follows Gibbs or it doesn't; the hull performs well or it doesn't. But Frazer's group introduced a new type of evolution into their models, allowing unquantifiable human factors to influence the direction of their algorithms. They did this simply by allowing people to intervene directly in the process of evolution. With the yacht hulls, the designer could influence evolution so that good-

looking hulls, or ones which worked best with a particular deck layout, would be chosen. At last, aesthetics had fused with computation, and genetic algorithms began to look like a useful tool for all types of design.

Current evolutionary models fall into two distinct types. "Convergent" models allow the computer to run its course, gradually optimising a design where the criteria for success or failure are known. "Divergent" models produce a wide range of mutations, allowing the designer to choose from a limitless range of ideas. In divergent evolution the computer becomes an aesthetic prompt, an ideas factory which the designer uses as a basis for creation. Genetic design uses aspects of both types. In the architectural practices of the future, quantifiable aspects of a design such as earthquake resistance or ventilation flow might be convergently modelled,

with natural forces

while the shape of an arch or the layout of a roof may originate in a divergent model. The partnership of human and computer is, says Frazer, one of the most exciting aspects of evolutionary architecture, the almost symbiotic relationship giving the lie to the worries about "dehumanisation of creativity" that some designers still express about computers.

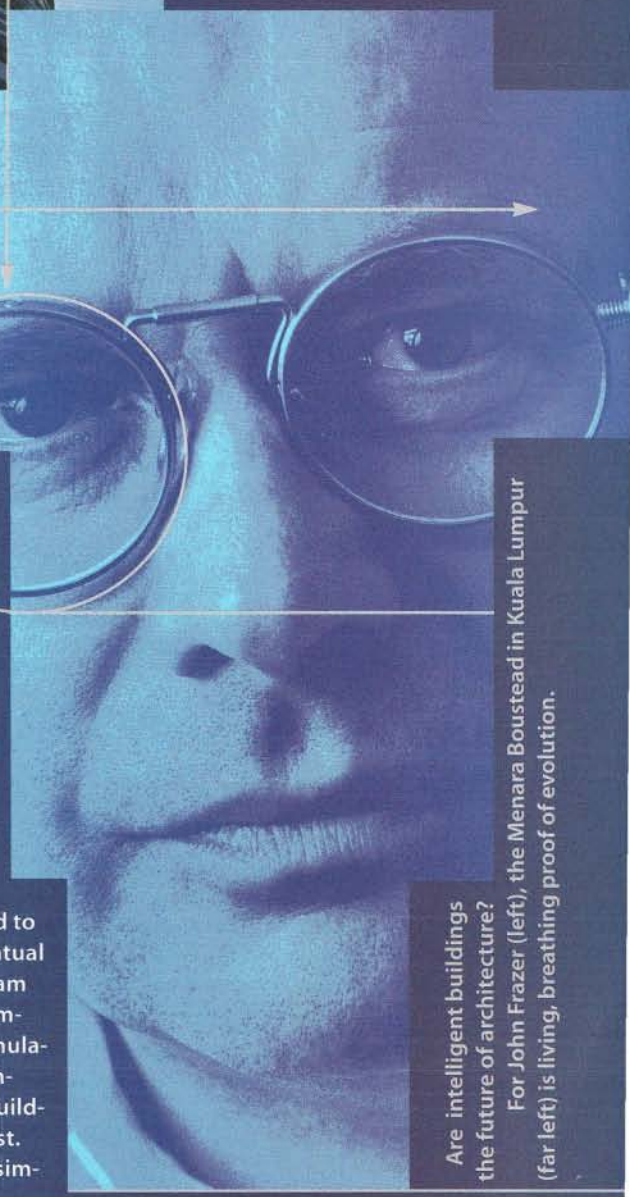
Let the sun shine in

Frazer's group has already tested convergence in some areas of architectural design. With the yacht project under its belt, his group turned its attention to the surprisingly complex architectural problems caused by the sun. Creating the right balance of light and shade is a primary consideration in any design, but it can be far more than a question of aesthetics, especially when building skyscrapers. Anyone who has sat by a plate-glass window on a summer's day or attempted to use a computer screen with the sun streaming in through the window will know why.

For many years architects have used complex diagrams to plot the course of the sun over their sites, determining where to place the shades and windows. Unfortunately these two-dimensional representations are confusing and are frequently interpreted incorrectly. Even giants like Le Corbusier and James Stirling have made serious sunshading mistakes – arising from basic errors, such as confusing the type of projection on their plan. Failure can land the architect with a permanent reminder of his arithmetical deficiencies.

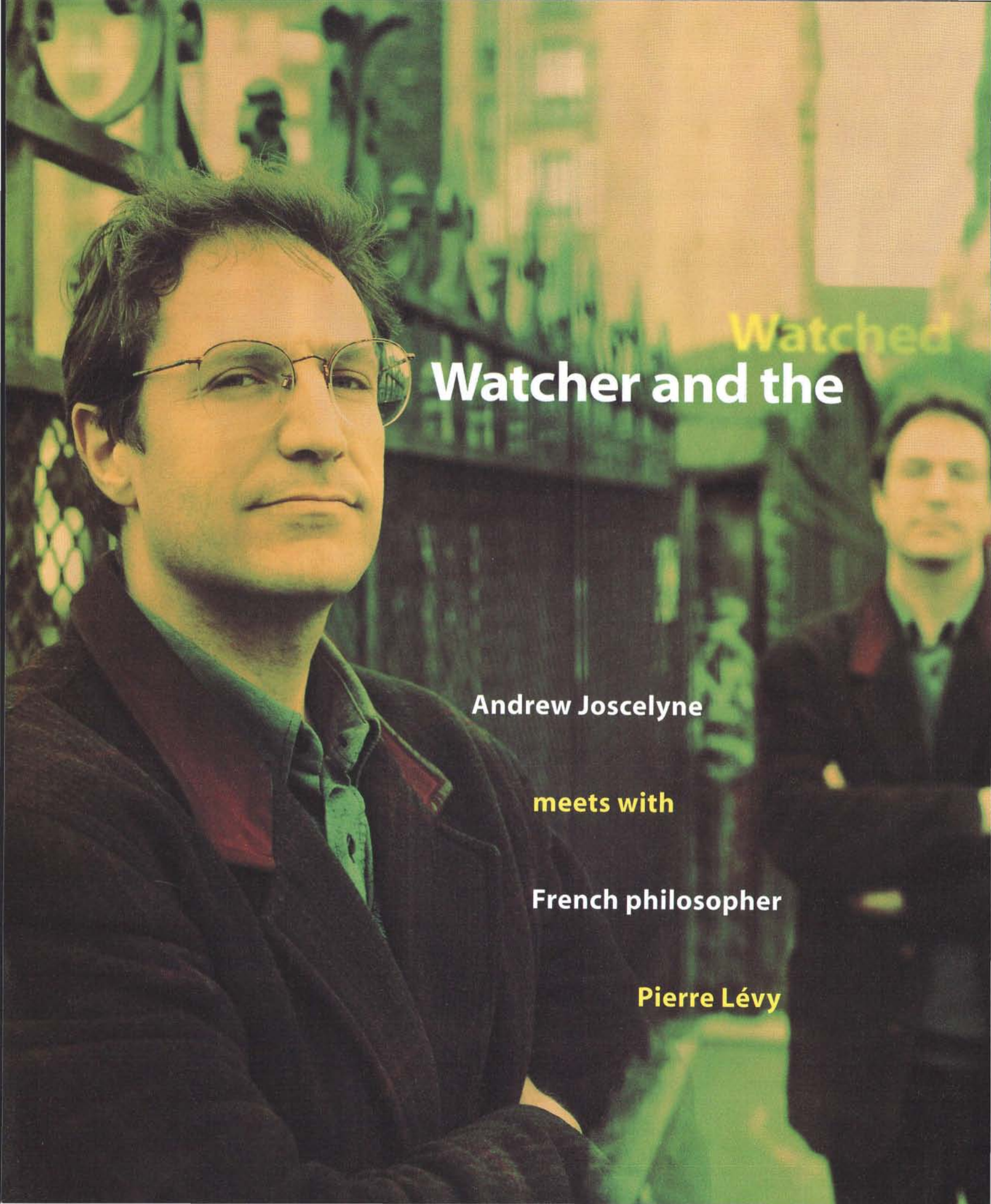
Having studied the problem and built a number of conventional computer simulations, Frazer's team then turned to an evolutionary model to design efficient and accurate methods of sunshading. A circular form was allowed to grow, responding to the movement of the sun over its simulated surface. Protecting an inner core, the structure's surfaces moved outwards in the direction of greatest solar radiation, with edges and planes curving up to shade exposed areas. The results were beautiful, functional and very different from the shade shapes a human designer might have chosen intuitively. This simulation software, and other sunshading tools developed by Frazer's team, are being assessed by architectural practices throughout the world.

Although these results are promising, modelling for sunshading is one of the easiest tasks evolutionary architecture might be expected to perform. The eventual goal of Frazer's team is to produce a complete, accurate simulation of the environment in which a building is going to exist. Designing such a simulation will be an incredibly complex task, since a building's environment can encompass everything from the climate to the number of people who are going to use it. Charles Jenks, leading architectural writer, is not convinced that such modelling is possible. "Frazer's main 111 ►



Are intelligent buildings the future of architecture? For John Frazer (left), the Menara Boustead in Kuala Lumpur (far left) is living, breathing proof of evolution.

VALERIE BENNETT/AA, ERANWYN BLACK/AA



Watcher and the Watched

Andrew Joscelyne

meets with

French philosopher

Pierre Lévy

Wired: You claim to be a philosopher of cyberculture. What leverage can philosophy really get out of the digital revolution apart from a few suggestive metaphors?

Lévy: It's a mistake to contrast ivory-tower philosophy with the get-it-done world of technology. A glance back at history shows that we have always used what I call "intellectual technologies" to do our thinking in the first place. After all, what are structures such as stories and rhetoric but technologies for organising our mental world?

In fact I'm rather surprised that philosophers have on the whole had so little to say about the implications of digital technology. Surely what is really interesting is precisely the fact that computers are transforming our relationship with the fundamental categories of our mental life – our memory, perception and imagination. To put it more philosophically, computers have changed from the inside what it means for something to be a thinking subject.

Your latest book, on "collective intelligence", reads like a paean of praise to the democratic possibilities that fully interconnected cyberspace could open up. Why are you optimistic about the pattern of relationships between communication technologies and political systems?

First, let's be clear what we mean by "collective intelligence". For me it entails understanding how techniques of communication can unite the intellectual forces and imagination of each one of us in a greater whole.

I see three types of communication that have given rise to collective intelligence in one form or another. First the non-interactive, one-to-many communication pattern of the mass media, in which people are simply fed knowledge from a small group of talking heads. Second, the telephone system, which is a genuinely interactive communication medium (many-to-many) but which cannot provide a visible map or memory of the collective whole that it creates. And third, the combination of communication and interaction in computerised networks, where the act of communication actually creates a continually new context of learning.

Doesn't your positive, humanist vision of Net power run the same risk as any other vision – you end up imposing a preconceived scheme on a context that by your own definition will try to escape from it?

The great fear haunting any political project is that it might secrete the hardy seeds of totalitarianism. The classic formulation of total control is George Orwell's "Big Brother is watching you". Our present era of media politics – the society of spectacle – has completely reversed these terms: slumped in front of our TV sets, we're more likely to say "we're watching you, Big Brother". In cyberspace, however, we are both watcher and watched, continually shifting roles in a moving drama, the result of which will form the collective self–knowledge of the community concerned. There is no centre from which to be or see Big Brother.

In fact I suggest that we start shifting the centre of attention from "democracy", rule by the people, to what we can call "demodynamics", power by the people. Instead of thinking of democracy as a complex process by which representatives are elected to rule, we must incorporate into our communicative life the huge potential for real-time consultation and debate. It is essential that we start exploring this positive option soon; if we don't, our worst fears about misuse will inevitably translate into reality. Fast.

You have also tried to promote what you call "a dynamic ideograph system (DIS)" to enhance computer-based communication. How does this mesh in with what most of us simply call interface design?

The concept of DIS follows on directly from the vision of collective intelligence. I propose going beyond the linguistic medium of written text and exploring the possibilities opened up by the semantic dimension of software objects.

A DIS would be an open-ended library of autonomous "signs" that have their own memory and can interact with others. These signs could include icons of cross-culturally meaningful objects and operations. In the same way as today's GUI icons are gradually taking on more and more functions, DIS ideograms would be both meaningful objects and logical operators, able to do something when activated – hence "dynamic". In a sense a DIS means communicating with agents. But a DIS would also exploit the dynamic qualities of animated images. Current video games already use something like crude ideographs to represent generic types of characters. And animated models are now appearing in scientific research as a way of visualising complex scenarios.

Using these as-yet-to-be-developed ideograms would be a dynamic writing technique worthy of computer communication. Be careful, though! It should not be confused in any way with multimedia – they are exact opposites. Multimedia has so far proved to be a new way of packaging pre-existing content, rather than a thorough-going intellectual technology. The DIS is an attempt to think out the qualitatively new.

Any ideas on wrapping these concepts of ideograph systems and collective intelligence back into the activity of philosophising?

The canon of philosophy, which is basically about the joys and sufferings of ideas, is an ideal candidate for a subdomain of a DIS. The advantage of such an approach would be to offer an escape from the essentially textual tradition underlying philosophy and give precedence to the interaction of ideas. I'm devising an ideograph system for exploring new relations and potentialities among philosophical ideas, as an alternative to seeing them as texts.

If Leibniz were alive today, he would almost certainly have put his ideas or theories in a relational database. There is no dominant centre or deductive foundation to the world of his ideas. They could all be linked in various interesting ways.

And Hegel would have been a computer-graphics freak, showing how insides can turn into outsides through time, how lowers transform into highers, how processes can somehow transcend themselves and contrasts blend into superior unities. He would have been into morphing. ■ ■ ■

Pierre Lévy is a leading French thinker on cyberculture. As well as writing a number of books on the intellectual dimensions of digital technology, he has been closely involved in an innovative practical attempt to apply interactive network technology to an alternative educational system (*Les arbres des conniassances* – "Knowledge Trees").

He currently teaches in the Hypermedia department in the University of Paris VIII. He is the author of *La Machine univers*, *Les Technologies de l'intelligence* and most recently *L'Intelligence collective: pour une anthropologie du cyberspace*, which are published by La Découverte in Paris, but are not yet available in translation.

Andrew Joscelyne is a Paris-based business writer who is currently preparing a book on human language in the digital era.

STEVE DOUBLE

PEOPLE ARE SUPPOSED TO PAY FOR THIS STUFF?

Crisscrossing the United States, our intrepid correspondent visits corporate labs, model living rooms and actual sofas – to check out the megahyped interactive television prototypes and see just how real the 500-channel, all-digital, high-fibre future really is. By Evan I Schwartz

Finally, hands-on:
GTE mainStreet
Microsoft Interactive Television
Time Warner Full Service Network
Bell Atlantic Stargazer

It's lunch-time on a Friday and I'm working up an appetite, shopping on the television. I ain't watching no infomercial: I'm wielding an 8-inch remote at a GTE mainStreet marketing centre – hard by Boston's Route 128 – controlling which products appear in front of me. The interface for GTE's mainStreet interactive TV service reminds me of the announcement boards on a local community-access channel: low-budget graphics with Muzak in the background. Arranged in *Celebrity Squares* fashion on the opening screen are nine stylised photos, each representing a category or "world" of activities. I've chosen world Number One: shopping, represented by a ribboned package. After breezing past screens that promote a virtual bookstore, a clothing boutique and a flower stand, I linger at the Flying Diner specialty foods storefront, where I'm beguiled by a glistening, 9-pound, honey-glazed ham. I've

Evan I Schwartz (eis@murrow.tufts.edu) *is a Boston-based contributor to* Wired *in the US.*

CRUNCH
EXIT

sure got a hankering for that ham. With merely a twitch of my thumb, I guarantee that this great hunk of hog will arrive tomorrow.

Then, all of a sudden, the screen freezes – like a PC with a memory-protection error.

This is how my bumpy cross-country tour of America's interactive television test towns began. My travels took me to corporate labs, model living environments and real suburban sofas near cities such as Boston, Seattle, Orlando and Washington, DC – a sampling of the places where the biggest telephone, cable and entertainment companies have been setting up technology trial zones. I wanted to see for myself what's been billed as television's true destiny.

Perhaps, I thought, I would learn the truth about the 500-channel, all-digital, high-fibre world of the future. Will it be a happy time, bursting with "choice, control and convenience", the mantra of every corporation getting into this business? Or will we take one look at it, snort and go right back to reruns of *Baywatch?* For that matter, will it even happen? Will you want to "turn your living room into a mall", as the Time Warner brochures promise? Or are so many industries rushing to make television interactive for the same reason that dogs lick their genitals – because they can?

With that thought in mind, I identified my quest: ignore the insider industry positioning and regulatory battles and get answers to the basic questions: Exactly what is interactive TV? What do people *say* they want from the experience and what do they *really* want? What types of services will they pay for and how much will they pay? Does interactive cable have staying power? Or will the personal computer end up with all the interactive goodies in the end? The answers to these basic questions will determine whether the New TV will be a multibillion-dollar bonanza or the biggest business boondoggle since New Coke.

The first home on the expedition is just a few miles from my digs in Boston. I arrive during prime time on a Tuesday at a two-family walk-up in Watertown, a slap-bang-in-the-middle-class community that borders Cambridge, Massachusetts, and happens to host the largest concentration of Armenians in the country. The residents, Seda and Dikran Kaligian, 29 and 33, live in a small apartment with classic movie posters on the walls and toys for their 10-month-old son on the floor. Recently, they got a call from Continental Cablevision, their cable company, which is helping GTE sell mainStreet as a premium service. "It sounded interesting and I wanted to see what all the talk of interactive TV was about," Seda explains, handing me a cup of tea and inviting me to sit on a low-lying cloth sofa.

As it happens, the Kaligians were in the market for something interactive. They recently cancelled Prodigy for their Macintosh because it was too slow. Actually, mainStreet isn't all that different. Like an online service, mainStreet ties up a phone line, this one jacked into the back of a special set-top box. The "upstream" signals from the remote travel over the phone line to GTE's central computers. Those computers then pump the programming "downstream" over GTE's fibre-optic rivers, which lead into Continental's regular coaxial cable offshoots and back into living rooms like this one. As such, the images appear much more quickly than they do on a PC with a modem – making mainStreet a kind of Prodigy with pictures.

Seda flicks on the tube and switches to mainStreet, which appears on cable channel 3. From the opening *Celebrity Squares* menu, we enter world Number Two: games. It's nine o'clock, the nightly time slot for *MatchPlay*, a multiple-choice program based on "repurposed" footage from *The Joker's Wild* series of the '70s. "It's so retro," Seda says. "I remember it from sick days when I was a kid." The host is none other than Jack Barry, who was portrayed in the 1994 movie *Quiz Show* as a conspirator in the 1950s game-show scandals. Here he is again, posing brain-bending questions such as "What was the last name of Barney, the nutty character played by Don Knotts? Was it: A) Rubble B) Fife or C) Google?" The choices flash on a graphics overlay that borders the video.

"All of us are really two people – the person we say we are in focus groups," says GTE's Barlow, "and the real person deep inside."

As we play, it becomes clear that the canned contestants on the tube are no match for the Kaligians. Seda points her remote while the footage automatically halts for five seconds to give home viewers time to answer. After pushing the B button, she watches a confused contestant with an ultrawide collar wager his guess: "That would be … Google!" he blurts. "Google?" Seda laughs. *"Google?!"*

The Kaligians say they are happy interactive customers and will keep up their monthly subscription at $9.95. Seda says she uses it about 30 to 45 minutes per night, part of her average four to six-hour TV day. Occasionally, they use the system's information services, most of which resemble one of those local information kiosks in an airport terminal. Recently, for instance, the family went out to eat after previewing the menu and decor of a local restaurant on their TV. And by calling up data from the system's Mobil Travel Guide, they learned about an inn in Amherst equipped with all-important cots. But, they say, almost all of their mainStreet time is spent playing games.

As creators of the longest-running interactive TV service, GTE is finally finding out what people like the Kaligians really want. When the company first conceived mainStreet in the mid-1980s, the $20-billion telephone giant naturally thought that people yearned for an interactive Yellow Pages to find information and buy things. Market research in affluent suburbs in the late '80s confirmed that hunch, as well as a crying demand for educational services, such as electronic encyclopedias. "We held focus groups to ask people what they wanted," recalls GTE's Barlow. "Number One, they said they wanted an interactive shopping centre. People saw it as a time and labour-saving device. You come home, pay your bills, shop, get your chores done and get on with life. But we created the service based on that and no-one watched it."

Now GTE knows not to rely on

focus groups. "All of us are really two people – the person we say we are in focus groups," says Barlow, "and the real person deep inside."

With that lesson learned, GTE went back to the drawing boards and repositioned the service based on usage data. GTE saw that people were mostly paying lip service to the education, information and time-saving features. So, the company's new infomercials and marketing pitches hardly mention those. Instead, they emphasise the fun and entertainment aspects of mainStreet – the ability to play along with game shows, compete in trivia games, predict during football season whether the quarterback will pass or run with the ball and participate in special events, such as voting for your favourite actors on Oscars night. Coming soon: betting fake money on horse races. GTE executives might not admit it now, but it looks like gambling could be their killer application. Too bad US law still forbids placing bets over phone lines.

Without some new revenue source, the system may never be profitable. At the start of 1994, after 10 years of developing and testing the service, GTE set up mainStreet as a wholly owned subsidiary and has spent roughly $5 million each year over the past seven years, says Barlow. That's OK, say GTE executives. Just as long as it turns a profit by the year 2003, when GTE projects that up to 60 per cent of US households will have interactive TV. But that kind of reasoning begs the question: what's going to be the main draw between now and then? Will interactive games and sports be the ticket? Do people have some kind of deep, dark urge to sit on their sofa and buy vowels from Vanna White on *Wheel of Fortune*?

It's possible. It could be that people like the Kaligians are desperate to interact with the medium that they have been watching so passively all their lives. Perhaps there is a pent-up demand among sofa spuds to get their 15 minutes on a nightly basis. But it's also possible that this concept of "interactivity" is so superficial that after a while the novelty will fizzle out. Weeks after my visit, I called the Kaligians back and asked whether they were still excited about mainStreet's interactive game shows. "We don't play as often as we used to," Seda admits.

Next stop on the tour: Redmond, Washington, where Microsoft and cable colossus Tele-Communications Inc plan to recruit 2,000 area homes by 1996 to test their incarnation of interactive TV. Cable subscribers in the area will get interactive games, information services, movies-on-demand and a graphical program guide to search through all this new stuff. Fibre-optic threads radiate from a new "head-end" control room on Microsoft's corporate campus and link into dozens of scattered neighbourhood "node" computers, where the data switches onto coaxial cables leading into living rooms. There, Compaq PCs are emulating the set-top box's role of decompressing the video and displaying it onscreen.

Overall, Microsoft approaches the business of interactive TV the same way it approaches computing. It wants to set the basic software standards and supply some applications while leaving the high risk of building capital-intensive hardware and networks to others. Microsoft has constructed an experimental network for this small test. But when the time comes to roll the technology out to the masses, it will delegate that work to partners such as TCI. "We won't dig up the streets and put $10 billion into the ground," says Laura Jennings, senior director of marketing and business for Microsoft's Advanced Consumer Technology group.

Instead, Microsoft intends to make money by selling software, not only to TCI but to dozens of phone and cable companies that are sinking $10 billion or so into the ground. Microsoft is creating not just the onscreen user interface, but also the MS-DOS-type software that operates the set-top boxes. Not to mention the Microsoft Media Server that sends streams of video to thousands of those boxes, plus the software that manages the basic operations of the network. Taken together, this is known as the Microsoft Interactive Television "platform". Southwestern Bell Video Services is among the other companies that will test the platform when it links up 47,000 homes in Richardson, Texas, starting in late 1995. At the same time as it supplies basic software, Microsoft is also creating content, such as PC-industry news programs, educational channels and shopping services.

In the process, Microsoft seems to be projecting the economics of computing onto this new market, as if watching TV were an exercise in productivity akin to setting up a spreadsheet. "The TV must make the transition from a broadcast appliance to a tool," says Lowell Tuttman, a group manager under Jennings. But isn't that the most absurd of uphill battles? It's the computer that was designed as a time-saving device. Not the TV. The TV has always been a time-*wasting* device. It's there to entertain you, not help you get things done. GTE has already learned this lesson.

But it's not surprising that Microsoft has headed down this path, especially as it and TCI have yet to supply this stuff to real people. In fact, I'm in town months before any real customers will get the technology. So, the most advanced home in the area right now is hidden inside Building 15 on the sprawling Microsoft campus. This is where many of the ideas for the upcoming test are being piloted for focus groups. On a Thursday morning, I'm accompanied by a Microsoft PR person past the reception desk, through a maze of halls and just across the head-end control room, where we encounter a sign in the corridor that says: "The Microsoft Home. Invited Guests Only". Under the sign is a door bell.

The door is answered by a man with silver braces on his teeth and a blond crew cut. His name is Pierre de Vries and his bio says that he was "trained as a theoretical physicist at Stellenbosch and Oxford. He worked for some years for a London venture capital firm, evaluating and managing high-tech start-up investments. He then turned to sculpture, concentrating on installation pieces that explored the relationship of people in space." This is the guy Microsoft hired to determine what normal people want to do in their living rooms at night.

The Microsoft Home, as designed by Pierre, is more like a luxury condo. Every room has a screen, from the multimedia PC in the kids room, to the financial news tube in the office, to the recipe tablet for "cooking apps" in the kitchen, to the projection screen in the den. The overall goal is fulfilling what Pierre calls his "vision of the extended family mediated though technology."

As we sit down on the deep leather sofas in the living room, the main electronic hearth completely absorbs my field of vision. First, Pierre demonstrates the video mailbox. We view a list of pretend incoming messages on the 50-inch screen. Pierre uses his remote to select a piece of mail that was sent yesterday at 3:32 by someone named Camille Savio. A woman appears. In a slight fish-eye view, she is standing in what looks like an airport at a public videophone – looking mightily confused and explaining that she was trying to reach someone else. This is much more enjoyable than your average wrong number, I must admit. But what if junk marketers got my video mailbox number? I have a feeling I'd be seeing much more of telemarketers from Visa and Sky than I would of Cousin Teri and Aunt Gilda.

The centrepiece of this demonstration is the interactive program guide. This early version of the guide groups broadcast programming, video-on-demand and information services into categories such as news, movies,

games, live sporting events and shopping. This guide is fairly simple and non-intrusive: 10 numbered choices appear on a transparent overlay on the bottom half of the screen. It looks like an advanced version of the setup menus for controlling volume and colour on any large-screen TV. You choose the corresponding number on the remote and progress into the submenu for that category. When you choose the video-on-demand option, for instance, you see a menu of movies listed.

The point of this and of all program navigators is to transform people from aimless surfers into efficient selectors. But just like the paper *TV Guide*, it presupposes that you'll know what you want to watch when you see it on a menu. If you have no idea – as is often the case for me – you're still going to surf through all the channels.

Microsoft has a solution for this, too. Instead of searching endlessly, Pierre figures that it would be interesting if the system had some built-in serendipity. To this end, a service called the Reactor presents nine random cartoon icons, arranged on the screen in the ever popular *Celebrity Squares* style. The viewer uses the remote to select three of them, such as a baseball, a globe or a church. We picked the gun, lips and elephant icons. The system then searches for a program that has these three elements in common. We ended up with the Sharon Stone movie *Sliver*. What does an elephant have to do with this? No-one can explain. Then we picked a guitar, a beach ball and the Swiss flag. This time, we got a 10,000 Maniacs video. "Maybe people in the band are from Switzerland," Pierre guesses. Actually, they're from Jamestown, New York. But no matter. "It just reacts," he adds. "It's supposed to surprise you!"

What surprised me is that he believes people would want to watch a program selected pretty much at random. Pierre may just be trying too hard on this one.

In fact, Microsoft seems to be over-intellectualising TV, in the hope that the software giant can break 50 years of viewing habits and change why people watch. "People have a money budget and a time budget," begins Thomas Wong, Microsoft's advanced consumer technology research manager. "And people are willing to pay to save time," he adds. Thus, he says, they will use interactive TV to rent movies; shop for food, clothing and household items; attend college and self-improvement classes; and get all kinds of information – all without having to leave their couch for time-consuming trips. That, he says, is what people in focus groups and surveys say they'll do.

The TV has always been a time-*wasting* device. It's there to entertain you, not help you get things done.

I don't think so. The reality, it seems after my first two expeditions into interactive TV land, is that people don't care very much about saving time when they turn on the tube. The average American watches between four and five hours every day, according to Nielsen statistics. If they were so pressed for time, where did they get these extra hours in the first place? People watch television for an entirely different reason: to feel that they are part of something larger than their own lives. Why else would so many people know so much about characters in Cicily, Alaska and the *Melrose Place* apartment complex without learning the names of their real neighbours? TV watchers seek out characters and stories with which to identify. It's a deep psychological fix that can't be explained in economic terms. They also turn it on for company, as background noise. And who needs interactive background noise? *Hardcopy* will do just fine.

It's not surprising that Microsoft doesn't grasp this. So many executives from Bill Gates down simply don't watch much on the box. Instead, everyone here seems obsessed with cramming as much as they can into their ultrasqueezed schedules. On the rare clear and sunny day of my visit, I watched as 4, 5 and 6 pm rolled by: almost all the cars in the Microsoft parking lots remained in place. Isn't it time to go home? One employee tells me he nearly kills himself on Tuesdays to finish work and race home to watch his favourite show, *Frasier*, by 9 pm. So many workers here make so much money and have so little time that requests for a pay cut in exchange for a less demanding job are all too common. These people want to buy back a piece of their lives. And they mistakenly think everyone else is like them. Which goes a long way towards explaining why Microsoft is hell-bent on misapplying advanced technology to solve problems that, for most people, don't exist.

Now it's on to the northwest suburbs of Orlando, Florida. The local economy here is built on fantasy, making it the perfect test zone for Time Warner Cable. On a sunny Thursday afternoon, I drive in my rental car up to Time Warner's Home of the 21st Century, a big white house that makes the Microsoft Home look like a yurt. Created as an idea house by Time Warner's own *Southern Living* magazine, this $700,000 dwelling is a high-tech jewel box perched at the edge of a newly sprung subdivision. I walk inside, meet up with Tammy Lindsay, the Time Warner PR person and begin showing myself around while she makes a phone call. As I ascend the stairs, I innocently walk into the home office, where a television spouting a canned demo passes off this remark to me: "Feel like a trip to the mall, but don't have the energy? Try the interactive mall!" I'm insulted. Do I appear so worn out that I couldn't even hop in my car and drive a few miles to satisfy my overwhelming urge to shop?

But as Lindsay shows me around and I peer with her into the future of television, I learn not to take it personally. At last count, she tells me, there were 13 TVs here, each desperately seeking something to do. The TV in the master bathroom, after all, is as big as the one I have in my living room. This is more like a media theme park than a house. In fact, Time Warner advertises this as a tourist attraction and charges the public $5 just to come inside and look around. Topping it all off is the fact that Lindsay is a former tour guide for Walt Disney World.

The most unwelcome site is a TV in the kitchen that presents Alfred the (Annoying) Electronic Butler, a talking, bespectacled cartoon face who does a bad imitation of an old-fashioned English butler. Next to his face is a menu of tasks you can program Alfred to do throughout the day. "Chip, chip, cheerio! Wake up and smell the coffee!" he blurts each morning from above the oven. Alfred then customises each of the home's seven electronic zones with its own mode of climate, security and media. At night, Alfred can be preset to appear while the master of the house may be scoffing down milk and cookies. Choose "bedtime" from the TV's onscreen menu and Alfred dims the lights, turns down the music, activates the alarms, and says: "Good night, sleep tight, don't let the bedbugs bite. And don't forget to brush!" Lindsay thinks he's just adorable. I have to suppress an unsettling urge to strangle this computer-generated image.

Maybe I can relax a bit in the den, where the world of Time Warner's Full Service Network awaits. I sit down in a soft reclining chair, while Lindsay picks up a sleek remote that looks like it was designed by Braun. She points it at a set-top box that resembles one of the early, ugly IBM PC

clones. The first image to appear onscreen is the Carousel, a 3-D merry-go-round image that she spins using the round, blue directional key on the remote. Ten different categories of interactive services are represented on the Carousel's graphical panels. Shopping, for instance, is symbolised by a green paper bag and a red-ribboned straw hat.

Everything on the system can be personalised. If your name, for instance, is Tammy, you can make a custom Tammy's News about, say, mutual funds, golf and computers – while blocking out news of foreign affairs and Congress. You can create a hot list of your favourite movies for repeat viewing.

Sterile, high-tech cocoons such as this are made possible by an ultrafast network operating behind the scenes. When customers on couches use their remotes to request movies, news and product information, their signals are sent to their set-top terminals and then they travel through coaxial cables leading from their home to a "node" stationed in the neighbourhood. That computer converts it to laser light and transmits it to the Network Operations Center in an office park a few towns away. Once there, racks of black demodulators sort the data into radio and laser signals and zap them over to an AT&T network switch. The switch sorts the signals and routes them to the appropriate spot on one of 16 Silicon Graphics servers. The appropriate video on those drives is pumped back over the fibre-optic threads to the neighbourhood nodes and to the set-top terminals, which decompress the video for display on the TV. All of the above takes place in half a second. And the whole process is a closed system, meaning the only content to appear is programs that Time Warner decides to create or license.

Let's see what Time Warner's idea of real people think of all this. At the time of my visit, less than 55 real homes are outposts for the company's Full Service Network. Many of those are clustered off the sidewalk-free streets of the Wekiva subdivision, located a couple of miles from where Alfred the electronic butler resides. Fifty years ago, this area was a wooded hunting preserve with dirt roads. Then came suburbia and the Magic Kingdom. This is where the Willards live.

Everyone in the USA knows the Willards. This is the media-coached family whose members tell ordinary Americans how much they can't live without the Full Service Network. Karl Willard, 43, a financial planner, his wife Susan, 39, a homemaker, and their kids, Jaclyn, 14 and Brad, 12, have hosted so many reporters and camera crews since getting the system last December that the family keeps a scrapbook and a video collection of appearances. For the Willards, the promise of interactive TV has already been fulfilled. It seems that whenever they watch it, they appear on it.

Oddly enough, Mr Willard hints that he's already tired of the Carousel. "You can bypass it," he shows me, pushing buttons on his remote. "If you know that you want to get to movies, you punch 98 and you just go." Then, he hands the remote over to Brad, who switches to a college basketball game and sits emotionless in a blue leather chair. As a photographer from *The New York Times* takes 30 minutes to set up his equipment in the living room, Brad doesn't interact with the TV. He just watches the game.

Oddly enough, Mr Willard has already tired of the 3-D Carousel. Now he just uses the remote.

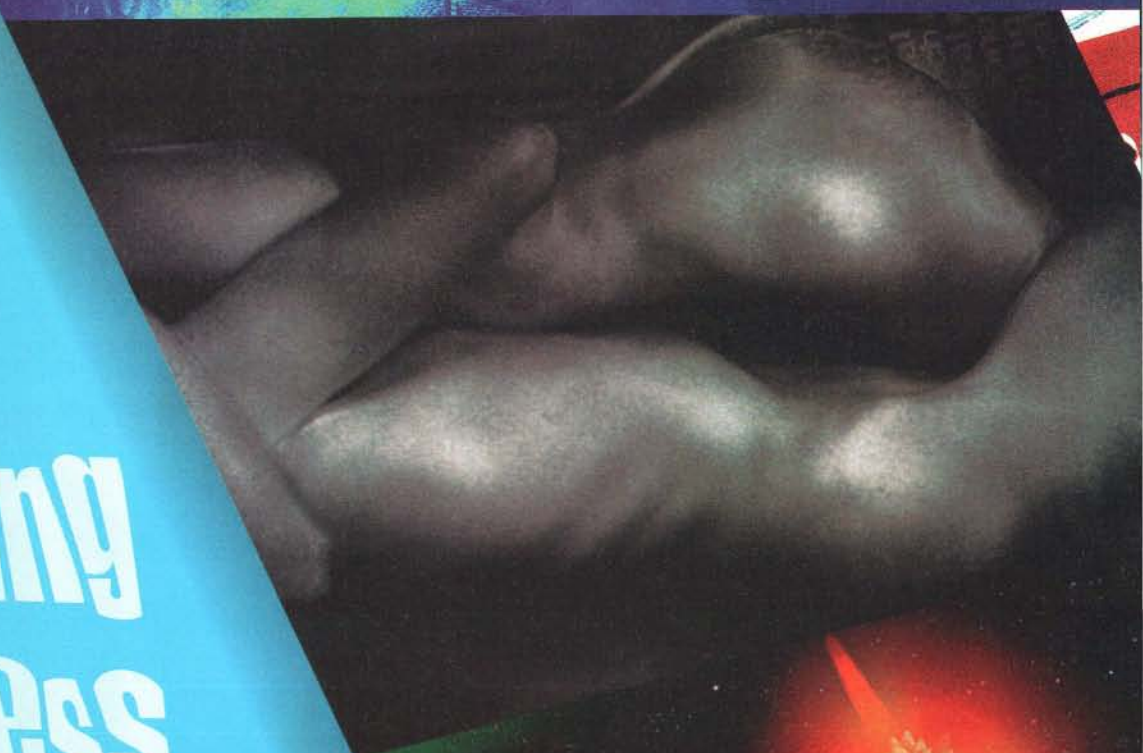
Mrs Willard swears that the interactive shopping features ease her daily burdens. Once, when she broke some glasses in the kitchen, she cruised the virtual Crate and Barrel store to order some more. Things cost about the same as they do in a real store, not including express mail charges. To me, all this seems about the same as a catalogue, except you have to put up with these extraneous graphics.

Mrs Willard seems especially excited about the forthcoming ShopperVision feature. The Willards have already seen demos of the service in which the viewer's cartoon grocery cart appears onscreen. Using the remote, you push your cart down the virtual aisle, zoom in on graphical product packages such as Captain Crunch boxes, read the nutrition labels and twitch if you want that product in your cart. Push a few more buttons and you can ring up your purchases for same-day delivery to your doorstep. This seems terribly dehumanising. It would put an end to thousands of years of human history in which food has been gathered in a real marketplace filled with people. What's more, the economics don't add up. The grocery business runs on one per cent net margins. That allows little room for supermarkets to invest in elaborate electronic shopping services in which they have to render 3-D graphics for every product on their shelves. And even Mrs Willard says she definitely doesn't want someone else picking out her tomatoes and melons.

Even the system's video-on-demand service seems unconvincing – at least at this stage. The Willards say they no longer visit their town's 16,000-title video store. But the Time Warner system offers only 60 movies now, with plans to bring that up to a whopping 150 by the end of the year.

Mr Willard insists that the new technology improves their quality of life. "We're a busy family," he says. Brad plays soccer. Jaclyn is a cheerleader. All members of the household say they watch TV for only about two hours a day. This makes the time they do spend watching more productive, he says. "I definitely like to save time so I can get on to something that is enjoyable," Mr Willard adds. "We're only on this earth for so long." He compares this system to the advent of the microwave oven. "I would literally fight them if they tried to take it away."

Yeah, but how much will he pay? Time Warner is now asking customers to pay $2.95 per movie. Given that the 112 ►



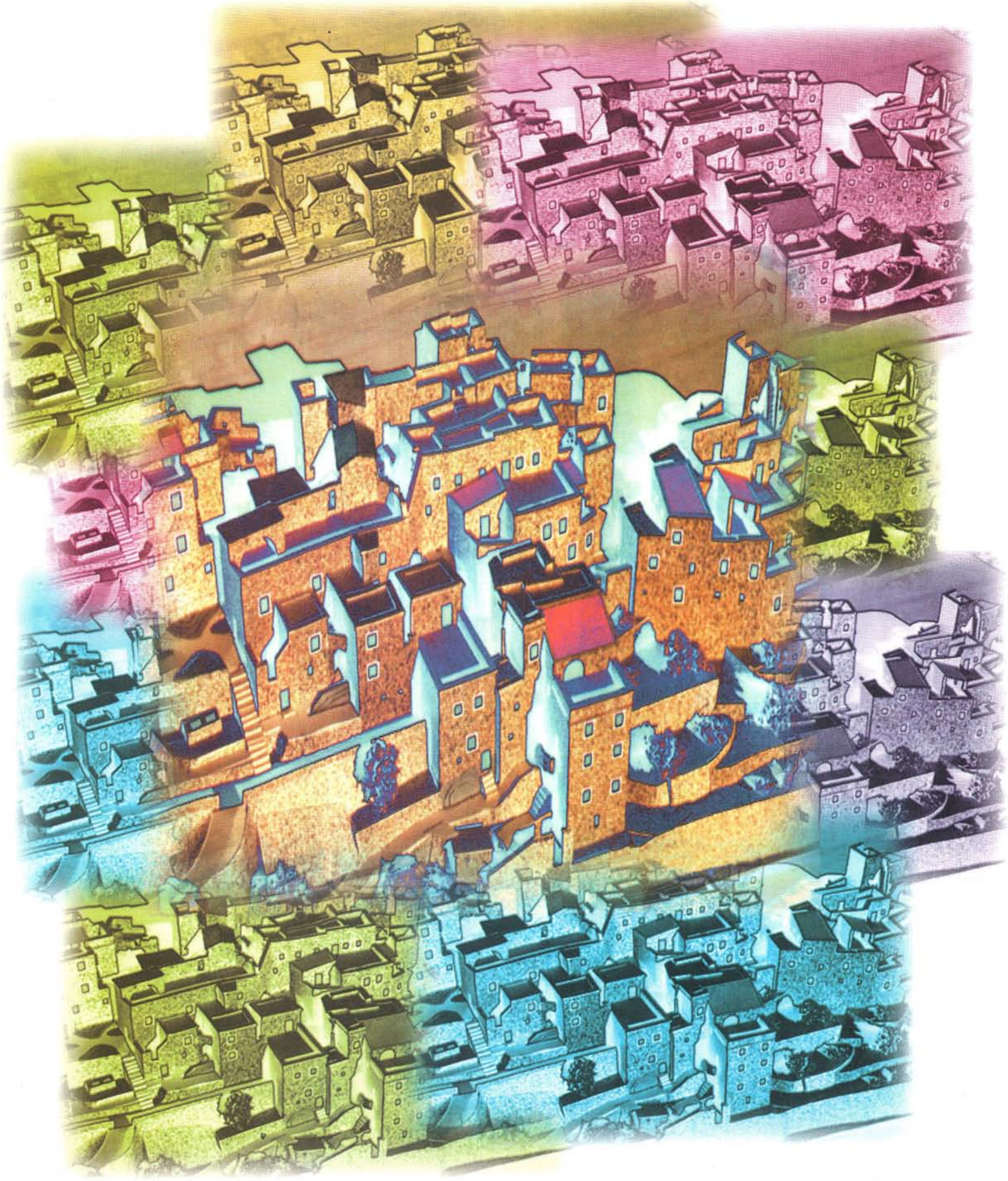
Spreading awareness

The AIDS quilt has become a key symbol of the struggle against an illness that remains a mystery. ArtAIDS takes this idea further, creating an interactive quilt on the Net. The spread is made up of images constructed for the Web-site, and images taken and re-worked, then posted back. Since the page(*http://artaids.dcs.qmw.ac.uk:8001/entrance/entrance.html)* launched on World AIDS day last December, there have been 350,000 hits.

The project is aimed at raising AIDS consciousness and was founded by Peter Ride of the Cambridge Darkroom Gallery and Andrew Nimmo of Queen Mary and Westfield College – who runs the Web server.

The quilt will be one of only two European entrants in the "interactive communities" section of this year's SIGGRAPH exhibition in Los Angeles. Already it has stimulated Chelsea College of Art. "We downloaded the whole gallery just after Christmas," says lecturer, John Clancy. "It's a way for students to use the Net for collaborative art – not just an exercise in pragmatic creativity, but in communication too." Surfers who like a particular ArtAIDS work can e-mail for a T-shirt version – all proceeds to CRUSAID, one of the UK's leading AIDS fundraisers. – *Robin Hunt*.

Paul
m Positive



La Dolce Vita Virtuale

Lee Marshall visits the medieval village of the future.

"The eagle suffers little birds to sing, and is not careful what they mean thereby," Shakespeare wrote. After a 400-year pause for reflection, we now know what he meant. The "lone eagles" of the information revolution let the chattering classes of the newsgroups spam their fill out there in the lower reaches of cyberspace, while they – the hovering elite – seek out their prey from on high. It's all there in *Titus Andronicus* IV.iv.82 (according to *gopher://ccat.sas.upenn.edu*).

Lone eagles are those professionals whose business is so virtual, or whose position within the organisation is so unassailable, that they are able to live anywhere. Lone eagles have no ties – but they do need a base. They need a sense of place, without the distractions that real communities so often bring with them. History, without the payback. What could be better, then, than an abandoned village in the hills?

There are plenty of these on offer in Italy – though you need to be eagle-eyed to spot them. Nature doesn't take long to reclaim its own, and crumbling walls draped in ivy have a tendency to blend in with their surroundings.

Colletta di Castelbianco, a few kilometres inland from the rugged Ligurian coast near Genoa, is such a place. It was rocked by an earthquake in 1887, but it was natural selection, rather than natural disaster, that finally did for Colletta. Some time after the last war, the remaining inhabitants finally admitted that this had been a lousy place to build a village and headed off to Marseille, where a small group of them still live.

Perched high above the Pennavaira torrent, Colletta could support only a tiny agricultural community from the terraced smallholdings that stepped down into the valley floor. When the village was founded in the 14th century, about the only thing it had going for it was what it had going *against* it: it was in the middle of nowhere. The Saracens were unlikely to penetrate this far inland and, even if they did, why go to the bother of raping, sacking and pillaging a pimple on the landscape?

Finally though, at the butt-end of the century which seemed to have condemned it, the village has been granted a last-minute reprieve. The middle of nowhere is back from beyond and back in fashion. Colletta di Castelbianco is being turned into Europe's first purpose-built Internet Village.

Lone eagles need eyries. So gambling on the eyrie futures market, a young, go-ahead construction agency called SIVIM, based in the northern Italian town of Alessandria (hometown of Umberto Eco, himself a restorer of things medieval) chased up the heirs of the village's last inhabitants. They didn't need much persuading to sell what they hardly realised they owned, and SIVIM clinched the deal for three billion lire – just over £1 million.

Colletta's tumbledown houses are being restored by architect Giancarlo De Carlo to provide around 60 self-contained living units. Most will have a minimum layout of living room, bedroom, kitchen and bathroom – all any self-respecting lone eagle needs. De Carlo is a believer in what he calls "non-violent architecture". He is aiming to reconstruct the village "without altering the genetic code which regulated its growth in the past". The whole project should be completed by 1999, although the first nine apartments have already been sold straight from the drawing-board.

So far, so what? A village of second homes, minus the distraction of local inhabitants with their muddy tractors and rowdy kids buzzing about on Vespas? It's been done before: a few years back, a whole Tuscan village was converted into a luxury timeshare hotel. What is different about Colletta – and what SIVIM is plugging as its number one selling-point – are the wires.

Telecom Italia has agreed to lay on fibre-optic ISDN cables straight away, making Colletta one of the few rural areas in Italy to be linked up to the network before the end of the century. What this means in practice is that each line will carry two 64K channels, allowing the subscriber to download a file while talking on the phone. ISDN also opens up user-access to high-speed Group 4 fax machines, digital phones and videophones. And in addition, Colletta will have its own Internet server, connected to the village's local network by radio. Small transceivers attached to each PC will allow Colletta's happy tappers to drift from room to room or outside on to the flower-strewn terrace as the mood takes them.

But wait: there's more. Colletta's two cafés will be wired, Cyberia-style, so residents don't miss that vital e-mail message while they're out getting their cappuccino fix. Teleconferencing and "interactive art performances" are also promised. Walking into an Italian village bar has always been the classic "a hush fell over the saloon bar as McBride swung open the doors" kind of experience. The sceptics might argue that it won't be all that different in Colletta: instead of hostile stares from red-faced peasants playing cards and drinking paint-stripper wine you'll get hostile stares from brokers playing *Myst* in between deals and drinking dry Martinis.

But in a country where the infobahn is still a novelty and nobody has started worrying about roadworks or queues at the tollbooths, sceptics are thin on the ground. Paolo Ceccarelli, head of the architecture faculty at Ferrara University, is one of the courageous few. At a conference organised for the launch of the Colletta project in November last year, he played the critic, presenting a paper entitled "Two PCs, the Osborne *Internet Yellow Pages*, a subscription to *Wired* and a mud hut."

"First," asks Ceccarelli, "what is the point of building a whole village around a communications device – the modem – which by its

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Lee Marshall (l.marshall@agora.stm.it) *is a freelance writer based in Rome. He's more a sociable coot than a lone eagle.*

very nature allows you to be anywhere in the world? Can you imagine hundreds of people all going to the same village to make their phone calls?"

And, as he also points out, the village may be founded on a culturally alien concept. "The myth of the 'lone' eagle has some relevance in a country like the United States, where the frontiersman instinct has never really died – but it certainly doesn't apply to Italy, where most people don't even leave their mothers."

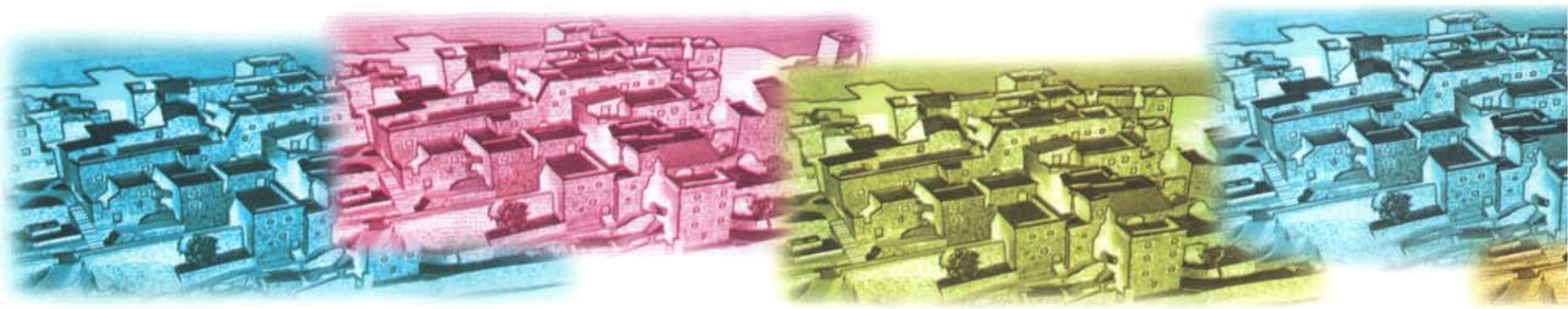
Ceccarelli says his worst nightmare is "the thought of so many telecommuters arriving from distant points, parking their BMWs out of sight of the village, climbing the stairs to their little monastic cells and plugging in their portables all at the same time, all oblivious to each other's presence. Here they start to tap away, making contact with other neurotics all over the world: it's a scenario which conjures up the great sanatoriums of the last century."

Giancarlo De Carlo, the architect responsible for the conversion of Colletta, isn't too worried about the village's future occupants. "Obviously, the reasons why Colletta was abandoned haven't gone away," he says. "So the new tenants will be different from the old ones: single people or families who are looking for a lifestyle which is online and comfortable at the same time."

What really excites De Carlo, though, is the medieval village as metaphor. He enthuses about Colletta's "crustacean" growth pattern: "the various living units have no fixed boundaries – you can imagine them expanding or contracting according to the needs of their users." This contrasts with what De Carlo refers to as the "vertebrate systems of contemporary architecture" – too rigid and sclerotic to adapt themselves easily to the new lightweight, hit-and-run needs of the global village. "Working on Colletta, I discovered something I had always suspected: the ancient stone-working techniques used to build these houses, with their very precise rules based on the nature of the materials, are perfectly adapted to support lightweight, advanced technology." In other words, it's easier to wire up the stone walls of the Middle Ages than the reinforced concrete of the technological 20th century.

Sounds fine and zippie. A quick Net surf, roast ox for tea and then out for a spot of jousting. Colletta, though, is a commercial proposition. De Carlo's vision of a crustacean organism made up of a number of cells which expand and dilate according to the needs of the community is unlikely ever to be realised: for obvious market reasons, the architect himself has been forced to divide up the cells into saleable units. So is Colletta just a holiday village with bells on?

From a quick survey of the first customers, the answer would seem to be yes. So far, those buying into the project include: a wine baron, a packaging king, a dealer in precious stones, a broker and a financial journalist. Each will have paid four million lire (around £1500) per square metre for their neo-monastic cells, bringing the price of a typical small unit to £100,000 – you'd pay the same price for a similar-sized apartment in central Rome or Milan.



Italians thrive on physical proximity, but you

The privately developed, top-down nature of the Colletta project makes it an unusual model among virtual communities. Ongoing experiments in the States are all based on pre-existing social infrastructures. The InfoZone, set up in 1993 by Richard Lowenberg in the small but chic mountain resort of Telluride, Colorado, is one of the most successful to date. The Telluride home page wears its community-serving heart on its sleeve: "The InfoZone ... is not merely the latest technical fix imposed upon our social landscape; it is a vital part of intelligently considered community planning ... that, by example, hopes to promote 'an ecology of the information society'."

Despite Lowenberg's commitment to the bottom-up approach, he takes a tolerantly ecumenical view of the future. "There are going to be many versions of telecommunity development as the information society evolves."
He is no optimist, though: such a barrage of differently angled shots is necessary, he believes, because it is going to be so difficult to hit the target. "The world's existing political, economic and social systems are compromising the possibilities of our collectively tele-mediated future. It will not be utopian. It will be just the opposite in many places

around the world." Tolerance is the key, he says: "Differences will be accentuated, so respect for difference will be critical."

A more recent experiment, launched in the town of Blacksburg, Virginia, went for a more hard-sell approach in order to persuade the entire local community to come in on the network set up by the town's university, Virginia Tech, in collaboration with Bell Atlantic. But after a year, no more than one in three households are connected. In theory, the butcher, the baker, the candlestick-maker and the local pizza parlour should all be hawking for business on the Net. In practice, says project co-ordinator Andrew Cohill, "what I call the reverse *Field of Dreams* theory applies. If you build it, they won't come. I've learned that it's not enough to provide the connectivity – you have to teach people its value. You have to show them it will mean something in their lives."

Another fundamental difference, however, concerns politics. For all their limitations, most virtual villages aspire to be local network democracies. Colletta, on the other hand, looks like a perfect example of a local network autocracy – complete with servant underclass. A local farmer has already offered his services as official *procaccia* to the village's new tenants. In rural Italy, the *procaccia* was a messenger and delivery man, a kind of medieval steward whose job it was to run messages, bring in the post and procure anything the inhabitants wanted. The Net lords of Colletta will send him off to the big city to buy all those things that The Middle of Nowhere so conspicuously lacks: condoms, Veuve Cliquot champagne, copies of *Wired*, digital tapes... A virtual serf for the virtual aristocrats.

Needless to say, harsh realities – virtual and otherwise – will be kept at bay. Indeed, the new village will be as impenetrable as the old one. As the PR brochure put out by SIVIM reassures potential buyers: "The cybernetic nervous system grafted onto the ancient structure of the village ... apart from acting as a gateway to the information superhighway, will constitute a protective barrier designed to filter incoming information, in order to protect the peace of mind of the inhabitants." Now that you've met the serf you can admire the battlements.

Some would say that such a fortress is an honest reflection of the essential elitism behind the whole "lone eagle" myth – but it's a peculiarly Italian one, in that Colletta's eagles are looking for safety in numbers. "You can't smell your next-door neighbour in the global village, and that's a big drawback in this country, where people thrive on physical proximity," comments Serena Vicari of the University of Pavia, who has been studying the telework phenomenon for the last three years. Like Ceccarelli, she believes that lone eagles are an American import that will not adapt well to European soil. "The technological limits are breaking down much faster than the social limits," she says.

Colletta is an example of what Richard Lowenberg calls a "community of desire" – those rural idylls which the footloose nature of life in the global village have suddenly put within our reach – at least in theory. But, on the other hand, Paolo Ceccarelli is scathing about what he refers to as "the myth of the rural utopia full of aspiring Thoreaus clicking away on their mice in charming little cottages immersed in the verdant wood."

can't smell your neighbour in the global village

Which is not to say that the revolution needs to be either urban or centralised. "Modern communications allow us to requalify and relaunch provincial centres which have extraordinary human resources and traditions, places which still have a lot to teach us," Ceccarelli adds. "Phones, faxes and motorways have already played a significant part in halting the drain to the cities and giving previously marginal areas – like the east coast of Italy – an important boost. The modem-and-computer wave will only take this process further."

Colletta's inhabitants relaunched themselves decades ago, by getting out. Requalifying and reviving a long-dead Italian village by rerouting some ISDN cables may provide some new opportunities for the heritage industry, but whether it will alter the future of society as we know it is yet to be seen. ■ ■ ■

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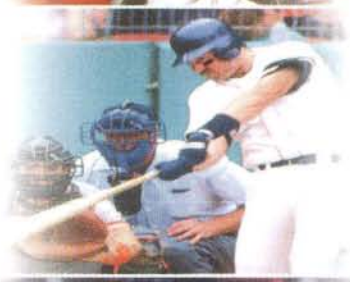

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Mind Your Language

I like telephones, I like answering machines and I like voice mail. But I just *love* Call Minder – BT's latest addition to its growing range of network services. It works like this: you pay a fiver per quarter to have it installed on your line (digital exchanges only, no PBX extensions). Then, whenever someone calls and doesn't get a reply within a certain number of rings, Call Minder cuts in and automatically takes a message.

Yeah, I know. It's certainly cheap, but this kind of service is hardly revolutionary, is it? Maybe not, but with the might of BT's national network behind it, this implementation has been particularly well designed. For instance – how do you know you've got messages waiting? There's an interrupted dial tone. You hear your messages by dialling 1571, and going through a brilliant voice-controlled menuing system – which actually works! (There's also a tone-control option – "1" for "yes", "2" for no – if you prefer not to be heard muttering "Yes. Yes. Yes." into your receiver like some demented phone-sex service for the incurably polite.)

The outgoing message and number of rings before answering can both be user-configured and, thanks to caller ID, you only need a PIN number if you're in the habit of picking up messages from a different phone. The

Call Minder offers a digital alternative to fiddly analogue answering machines.

service is friendly to the caller, too – they get to hear their message and re-record it if they don't like how it sounds. It's not Wildfire (see *Wired* 1.02, page 93) but it is very handy.

For obvious reasons, BT don't recommend Call Minder for use with modems or faxes that take a lot of incoming calls. But for those of us with just the one shared line (for phone and outgoing modem), it's a massive improvement on the execrable Call Waiting which – quite apart from the fact that it never seemed to swap between voice calls effectively – would drop carrier if you were online and someone was trying to reach you. Call Minder, however, will cut in if someone calls and you're already engaged – ideal for the net.addict who still wants to retain some links with the outside world.

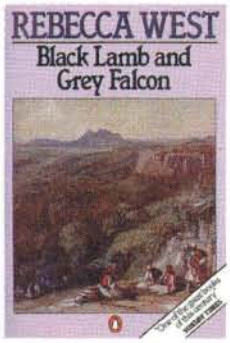
At last – an end to listening to those endless renditions of *Frère Jacques* from what sounds like the French National Stylophone Orchestra. My advice to anyone who owns an answering machine business: sell it now before it disappears from under your feet. – *Dave Green*

Call Minder: £4.99 per quarter (currently on free 3-month trial; available across the country to subscribers with digital exchanges). BT network services: 150.

Hot Spot

Anyone interested in the Balkans, the former Yugoslavia, Central Europe or simply one of the most beautiful bodies of writing ever to appear in print should get hold of *Black Lamb and Grey Falcon: A Journey through Yugoslavia* by Dame Rebecca West. Written in the late '30s, it records West's journeys to Yugoslavia. But her treks are merely the backdrop to an engrossing and educational ramble through Balkan history.

Set aside some time: this book is 1,081 pages long and every page has at least six sentences you'll want to



Nothing like a Dame.

underline and memorise for their sheer brilliance. What an extraordinary writer! I've found myself glued to *Black Lamb and Grey Falcon* until my eyes are groaning.

It's fascinating and frightening to see how many of the great and terrible moments in history had their genesis in this ever-simmering cauldron. Are we at another such moment, one wonders? – *Brian Eno*

Black Lamb and Grey Falcon: £16.95. Currently out of print in UK, published in US by Penguin Books, available from Compendium: +44 (0171) 485 8944.

Sharp Shooting

Forget contacting potential clients and organising your life. For me, LaserCue is what personal technology is all about. This tiny, black, extremely scary-looking tube, which mounts on a pool cue like a scope, projects a solid-state laser through a collimating and line-generating lens. The effect? A bright laser beam down the axis of the cue, across the cue ball and directly onto your target. The result? A better, tighter stroke and, ultimately, a better game, as the amateur pool player learns to make the cue ball follow the projected line directly to the target.

The beam reveals any unwanted lateral moves during drawback, forward-thrust and stroke. If the beam is wobbling around, so is the cue, and you won't strike the cue ball squarely; a steady beam means a smooth stroke.

A sight for sore eyes.

Even with the slight difficulty in getting the clamp device mounted (a snug, slide-on scheme would work better), LaserCue is easily the coolest in-your-face gadgetry accoutrement since the pearl-handled switchblade. And it's guaranteed to have an equal effect on your adversary. – *Chris Hudak*

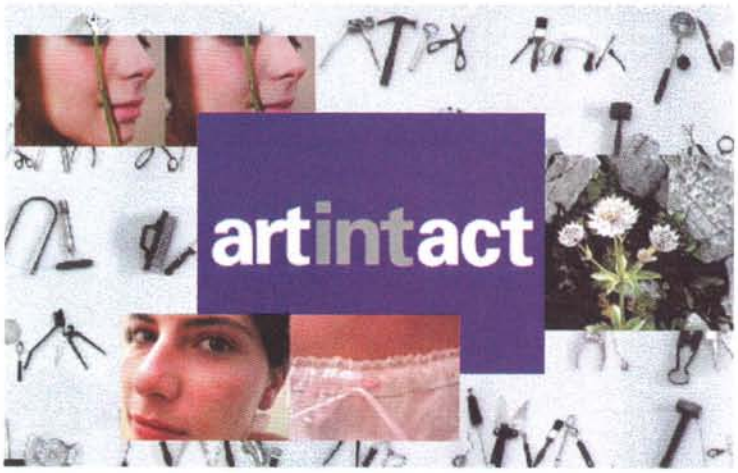
LaserCue: £129. Available from The Leading Edge: +44 (0171) 386 0131.

It's No Oil Painting

Here, finally, is something to show sophisticated friends when they sniff: "When will there be something intelligent on CD-ROM?" Three artists' work have already appeared in *artintact 1*, the first issue of *Artists' Interactive CD-ROMagazine* from ZKM, a multifaceted institute in Karlsruhe, Germany, that has ambitions to be the Bauhaus of the digital age.

Simplest in structure is *Manuskript* by Eric Lanz. What at first look like hieroglyphs become, on closer inspection, rows of tools – from salad forks to industrial saws to toilet plungers. The minimalist structure is an ironic commentary on taxonomic categorisations. Click on each tool and you start a short video showing it in action. What's that? Oh, a ring sizer. This guessing game is surprisingly engaging, but ultimately a bit thin.

More complex is *The Exquisite Mechanism of Shivers* by American artist Bill Seaman. Thirty-three sentences are broken into remixable groups of phrases, so you can produce absurdly poetic lines like "An ephemeral certainty triggers an enigmatic arrangement to escape the changing ramifications of a resonant desire." Videoclips associated with each phrase (panning landscapes, close-ups of machinery) allow sentences to be played as movies. The curious associations produced by jumbling video, sound and text create an endless multimedia update of the Dadaist "Exquisite Corpse" game on your Macintosh.



The word "exquisite" isn't often applied to CD-ROMs. But this one deserves it.

Most elaborate is French artist Jean-Louis Boissier's *Flora Petrinsularis*, based on Jean-Jacques Rousseau's similarly named book about flowers and his famous *Confessions*. Rousseau's memories of 16 amorous encounters are dramatised in pairs of short looping video animations, mainly voyeuristic close-ups of fetish objects (a bit of lace slipping off a breast, a pink sash coming untied) and faces (a tear running down a cheek, a seductive off-the-shoulder glance). Sixteen varieties of flowers get parallel treatment. Often, the paired clips show the same scene with a slight gap in time, to uncanny effect.

The disc comes embedded in a handsomely designed book containing learned commentary on the works in English and German. These three pieces, which all began as installations, have been reworked into delicate little gems and there's already a second issue on the way. Such intellectual meditations on the nature of seeing and interactivity won't be to everyone's taste, but at least you'll have something to show when the downtown crowd comes to visit. – *Jim Gasperini*

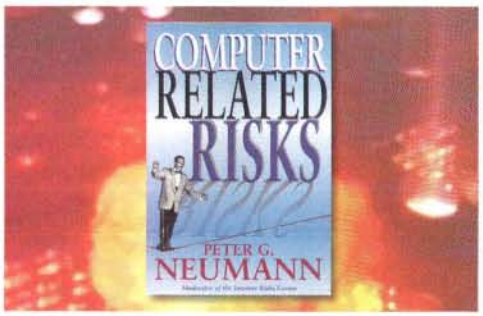
artintact 1 Mac CD-ROM: DM98. Verlagsgemeinschaft Hatje/Cantz: +49 (711) 449 930. Distributed in UK (from issue 2) by Art Data: +44 (0181) 747 1061.

Abort, Retry, Fail?

You just can't find a more complete catalogue of computer-related catastrophes than in Peter G Neumann's *Computer Related Risks*. In this book, you'll learn about telephone network and Internet failures, plane crashes, electronic privacy violations and even the occasional forged e-mail message. Poor technology implementations that can lead to such disasters are more common than you might think.

Some of the problems described arise from human error: Neumann details situations in which typos wrecked a space probe, caused a telephone system to collapse and blew up a European chemical plant. Other disasters appear to have their roots in faulty hardware. But, in the final analysis, most are the result of fundamental design flaws and accidents just waiting to happen.

Neumann, of course, is the moderator of The Risks-Forum Digest, one of the most widely read special-interest groups on the Internet *(risks-request@csl.sri.com)*. (See "The Dean of Disaster," US *Wired* 1.06, page 42.) In *Computer Related Risks*, Neumann brings the best submissions to the book, organises them by subject, and tries to analyse the repeated system failures that occur in our technological society.



Master of disaster Peter Neumann keeps track of risky business.

Where *Computer Related Risks* falls short is in the analysis. Neumann fails to present a comprehensive theory of risks. He also repeats himself: doubtless, he simply didn't have enough time to finish the book and keep up with his duties as a principal scientist at SRI International in Menlo Park, California.

Time pressures, of course, are another risk that can lead to hazardous system failures. Even as it stands, *Computer Related Risks* is a pleasure to read and a must for all who entrust their lives or livelihoods to a machine.

And that's all of us, isn't it? – *Simson L Garfinkel*

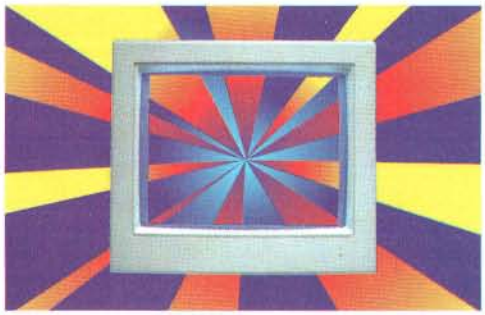
Computer Related Risks, by Peter G Neumann: £18.95. Addison-Wesley Publishing Company: +44 (01734) 794 000, fax +44 (01734) 794 035.

Box of Delights

Boy, this is a good idea. This is such a good idea, that I'm sure someone is losing out. I just can't figure out who.

Here's the deal. A group of companies in London share a 64 Kbytes/sec leased Internet line. It has capacity to spare. To eliminate that waste, one of the companies has formed a spin-off called VIRTUAL Computers. For a grand a year, VIRTUAL will lease you a 486 PC, install Linux (the freeware Unix) on it and set it up as an Internet site. Effectively, you own this entire box. You are root on that machine and can do anything that your whims decree. Naturally, because it is permanently on the Net, you don't need to be in the same room to avail yourself of these rights. Unix accounts were born to be controlled via telnet. VIRTUAL looks after the physical box, makes sure it comes to no harm and re-boots it if you do anything spectacularly dumb. You sit at home, accessing it via your own (separate) dial-up Internet account and generally doing what thou wilt.

A simple idea, but I have yet to exhaust its creative – and moneymaking – possibilities. Other sites might sell you 10 MBytes of Web site for a cheaper price. But with VIRTUAL, I have about 200



Stake your personal space on the Internet with a VIRTUAL PC.

MBytes of potential Web space. And it's more flexible too. I can write, test and install my own C and Perl CGI scripts, the core of any genuinely interesting Web site. I could have my own coffee-machine on the Web or more lucrative, I could run my own e-cash site, and still have processor time to spare for mailing lists, a BBS or perhaps a MOO.

The cost too much for just yourself? Well, dammit, this is Unix – it was designed for multiple users. People pay good rental for a Net login shell with Web pages. 10 MBytes disk space at £5 a month – very reasonable. Of course, they don't get to be root: but somebody's got to be in charge, haven't they?

The catch? Well, VIRTUAL have only just begun trialling their service, so you can expect that 64 Kbytes/sec to get eaten up fairly quickly: particularly when it dawns on VIRTUAL's customers that their machines can run as full-time Net crawlers, too. That could mean slower access; and I'm not sure what the other companies that VIRTUAL shares its line with will say to that. But who cares? I can program my Unix box around slow access too. Hell, I'm root now. I can do anything I want. – *Dan O'Brien*

486DX33 PC on shared 64 Kbytes/sec line: from £1000. VIRTUAL computers: +44 (0171) 490 1609.

Sir Mix-a-Lot

Most musicians nowadays are gearheads. Caught between hype and hope, they continue the hunt for that elusive piece of equipment that, manufacturers insist, will make their sound cooler and their demo tapes irresistible. While no piece of gear will ever win the creatively challenged that million-pound record deal, Yamaha's ProMix 01 is one of the most useful music tools since four-track analogue recorders. If you've got the ideas and roughly £2,000, no other mixer will get your music to disk or tape – or the house PA system – with so much value and convenience.

First, value. This 16-channel machine (plus an additional stereo input) comes with three stereo-dynamics processors for applications like compressing, gating, limiting and ducking. Musicians will delight to find there are also two internal stereo multi-effects processors for a variety of delightful reverbs, echoes, pitch shifting and chorusing effects. Having internal effects and gates means that your audio data stays in the digital realm and that patching is a breeze.

Second, convenience. The ProMix has motorised faders that allow for

If you like "mixing it" about, the ProMix does everything but write the songs.

automated mixing. You can store your fader positions and effects settings into "mix scenes", making mixing simpler and more precise. Anyone who's ever tried to do a complicated mix with just two hands can now put them together and clap enthusiastically; automated mixing used to be a feature found only on consoles many times the ProMix's price.

Want more, gear nut? Get this. Fully parametric 3-band equaliser Phantom power. Four auxiliary sends; two for internal use, two for external. A digital two-track out. Full MIDI control.

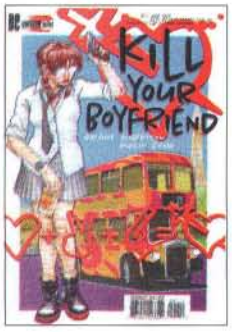
So, no gripes, right? Not so fast. The headphone jack is in a truly asinine, hard-to-reach place. The unit stank up my home studio for a couple of weeks with a foul, synthetic smell. And the rack ears for the machine are optional and difficult to find.

Still, this is a sweet deal. With prices dropping for hard-disk-based recording systems and modular, digital eight-tracks, the gap between home recording and the professional studio – once the size of the Grand Canyon – will soon be measured in mere inches. – *Rogier van Bakel*

Yamaha ProMix 01: £1,999. Yamaha UK: +44 (01908) 366 700.

Total Carnage

Never mind MPEG-2 – the ultimate in data compression must surely be that displayed in *Kill Your Boyfriend*, the much-delayed new one-shot from comics ultrastar Grant Morrison, which crams the whole of Quentin Tarantino's *True Romance* into a 56-page joyride of thrills, pills and spills (in that order). Taking pretty much the exact same tone as said movie (and working in some great *Reservoir Dogs*-style time-play to boot, where the heroine relates events in the past tense as they actually happen), the plot whips through a familiar story (boy meets girl, criminal behaviour ensues, shootout at the end) at exhilarating pace, with a new surprise plot twist in



***Literally* action packed.**

every second frame (in fact, I didn't even notice the big one just before the end until about the seventh read) and more ideas than every comic you read last year put together. It's beautifully illustrated by Philip Bond, the perfect penciller of every teenage hero you ever wanted to be, and the dialogue sparkles so effervescently ("Christ! He's airborne!") that Damon Hill's most enthusiastically-opened bubbly seems like lumpy cement by comparison. Trashy and throwaway, but at the same time the first truly, totally, literally essential comic of the '90s. – *Stuart Campbell*

Kill Your Boyfriend by Grant Morrison and Philip Bond: £3.30. Forbidden Planet: +44 (0171) 836 4179.

Redraw the Map

I've always dreamed of filming an animated map of Europe that would let me watch as the countries rise, grow, shrink, merge and disappear over the centuries. No need: *Centennia* has put it all on a floppy. I load it and then sit back to watch history unfold from AD 1000 to 1995, all as an animated cartoon.

Want to watch the Evil Empire fall? With a few clicks, zoom to the USSR in 1990. Then, using onscreen buttons as you would on a VCR, move forward, fast or slow, and watch it crumble like a cookie. For a bit of history, I ran the program in reverse and saw

Jeux avec frontières.

the nation shrink still further over the past three centuries. Gobbling up neighbours appears to have been a Russian pastime since at least the 17th century.

For more in-depth info, you can compare the maps for two different dates and even look up details of countries – events, historical figures and the history of its people. Coming next are maps of Asia, the Americas and the rest of the world. – *Ivan Berger*

Centennia for PC and Mac: US$89. Clockwork Software Inc: +1 (312) 281 3132, *http://www.clockwk.com*.

Better Than a Kick in the Teeth

When I was at school, my usual response to unarmed combat situations was to run away as fast as possible. But today, in my new persona as Sarah Bryant, college student from America, I'm more than happy to punch any would-be aggressor in the face, double-kick them in the stomach, then finish them off by jumping up and down on their head.

Fortunately, Sarah is in reality nothing more than my favourite character from Sega's *Virtua Fighters*, the "killer app" for their new 32-bit games console, the Saturn. The Japanese went mad for the *Virtua Fighters* arcade game, so when the Saturn was launched in Japan at the beginning of this year, sales of this conversion – and the console – were huge. The coin-op isn't as popular here, so will Sega be able to repeat that success?

In terms of gameplay, *Virtua Fighters* hardly brings much innovation to the beat-'em-up genre. There's you and this other guy (or girl), and you hit each other until one of you falls over.

But it's the animation of the 3D polygons that really make the game. The movement is so fast, fluid and generally realistic you can almost feel the punches and kicks connect. Much of the animation was motion-tracked from real actors (presumably Karate experts too ugly to appear on film), and it's all accompanied by some brilliant Kung Fu-style sound effects. It makes even the most over-the-top Ninja movies look restrained.

You'll also see it described as "Virtua Fighter", depending on translation.

The characters are beautifully designed, in that unique Japanese style. As well as my friend Sarah (whose hobby, by the way, is skydiving), other notable contestants include Jeffry McWild, a fisherman from Australia, whose hobby is apparently reggae music. (Exactly how he combines these various pastimes is never fully explained.) The lasting appeal of the game lies in learning the complicated sequences of keypresses that produce each character's spectacular special moves.

The Saturn is undoubtedly capable of much more, but the game is "virtually" (ho ho) indistinguishable from the state-of-the-art arcade machine that it's based on. Sure, the characters are made up of slightly less polygons, and there's some severe 3D depth problems – floor tiles pop in and out of existence like they enjoy it.

But even compared with the texture-mapped artistry of the PlayStation's *Tohshinden* and its own arcade sequel *Virtua Fighters 2*, *Virtua Fighters* on the Saturn still delivers the hits where it hurts. Never has gratuitous physical violence been so realistically – and so enjoyably – portrayed in a video game. Worried parents can at least be grateful that there are no firearms involved. However, I'm sure Sega are busy converting their *Virtua Cop* coin-op to remedy this situation. – *Simon Green*

Sega Saturn plus *Virtua Fighters:* £599.99. Imported by HMV Level One: +44 (0171) 631 3423.

Are You Feeling Lucky?

You know what lucky is? Lucky is having a pal who's a lot more cultured than your own white-bread ass so you can get hip to a lot of cool stuff without having to spend the time it takes to get that way in the first place. You know *who* Lucky is? That's Steve Sando – Mr Lucky himself.

Mr Lucky is a sophisticated guy in the San Francisco Bay area who lives every hour of his day in pursuit of two things – the heppest music on the planet and the best booze he can lay his hands on. *MisterLucky* is a zine he publishes every month to hip us all to the latest and finest in suave music and debonair drinks. Apparently, he has no real life to speak of, but that's good for you and me, because by reading his right-on music and alcohol reviews, we go straight to being cool and keep a real life to boot.

CDs really took a bite out of musical experimentation for most people. Who wants to take a chance when they cost £15 a try? That's where *MisterLucky* comes in. Sando flexes his lifetime's worth of record collecting and packs each issue with a good two dozen solid recommendations of what he calls "jazz-

Fortune flavours Mr Lucky's tasty cocktail of jazz and booze.

centric" music. Jazz-centric covers everything from early American jazz and bop, to classic Brazilian music, to blues, to Keely Smith, to basically everything that's too cool for just anyone to be up on. I know a fair amount about music, but I copped a load of serious CDs from leafing through a few *MisterLuckys* and, so far, I haven't bought one dud on Sando's recommendations. I'm usually of the view that anyone who calls himself a music critic should be pummelled with a tube sock full of dung, but Sando knows what he's talking about. And I've got to say that Sando's educated, witty and downright friendly writing is a welcome relief from the usual bitter-loser mentality most zine editors seem to suffer from these days.

Written for those who would define the perfect state as "listening to great tunes while expensive and delicious alcohol drifts through your bloodstream", *MisterLucky* is the drinking person's guide to fine music. – *Corey Greenberg*

MisterLucky international subscription: US$35 for 12 issues. Coconut Grove: +1 (415) 648 5803, e-mail *coconutg@wco.com*.

Dealing the Dirt

When authors publish their own books, it's usually for a reason – usually because they're bonkers.

Bryan Clough isn't mad, as anyone who has read *Approaching Zero*, his sober dossier of hackers and phreakers, will testify. But he's got a few odd ideas. His new book, *Cheating at Cards*, predicts the demise of plastic cash – and with it, the high-street banking system.

Credit card fraud is too easy, you see. And electronic money won't save the banks. Alpha particles from the sun and stars can "mutate a binary zero into a one and vice versa" – and there's another peak of sun-spot activity due around the year 2000. "Anyone testing a computer-based product, like

Pick a card – any card.

Mondex, in 1995, may proceed with the launch without anticipating the effects of the sun spot cycle a few years later," warns Clough.

It's not all hocus-pocus. There are tips about nail varnish on phone cards, debossing, Nuron CT670-3 encoders and the creative possibilities of Z-Term on the Mac. There's a great page on the stuff auctioned off when BCCI went belly-up; and how to invent your own Visa numbers.

Just one thing before you send your cheque: do you really want this man to know your bank account details? – *Robert Leedham*

Cheating at Cards, by Bryan Clough: £19.95 + £2.00 p&p. Hideaway Publications, The Hideaway, Furze Hill, Hove, East Sussex BN3 1PA.

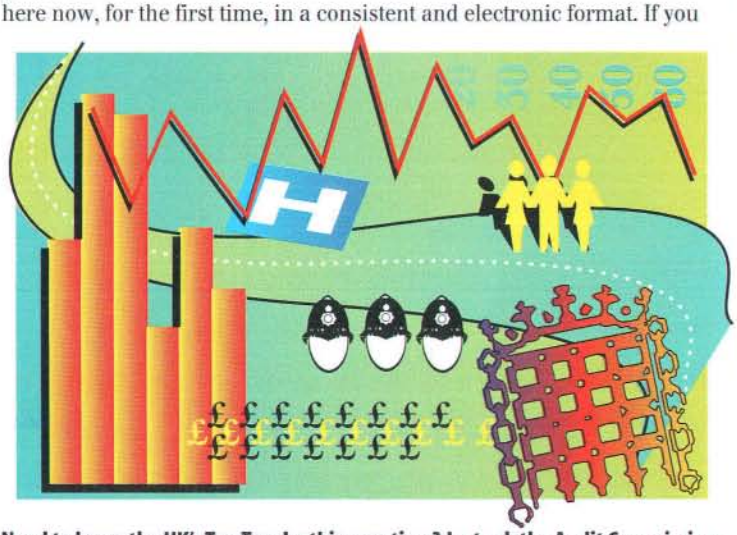
Garbage In – Garbage Recycled?

Not this month's most hyped or most fashionable new publication perhaps, but few are as significant as the latest release from the Audit Commission.

Under new legislation, councils and police forces now have to set themselves public standards and then monitor how well they're getting on with tasks like answering 999 calls and solving crimes. The Audit Commission, an independent watchdog set up under Mrs Thatcher, has researched which ones mean most to the public and assembled the relevant statutory returns into three concise volumes. They are also available as Excel files on disk.

For a start, they reveal huge discrepancies in council performance. Around the country, councils show ten-fold differences in how much household rubbish they recycle, how many tenants are in arrears or how many overnight breaks they give those caring for the elderly or disabled.

It's not always as simple as best and worst. Circumstances vary and people have different priorities. But the breakthrough is that the data is here now, for the first time, in a consistent and electronic format. If you



Need to know the UK's Top Ten dustbin emptiers? Just ask the Audit Commission.

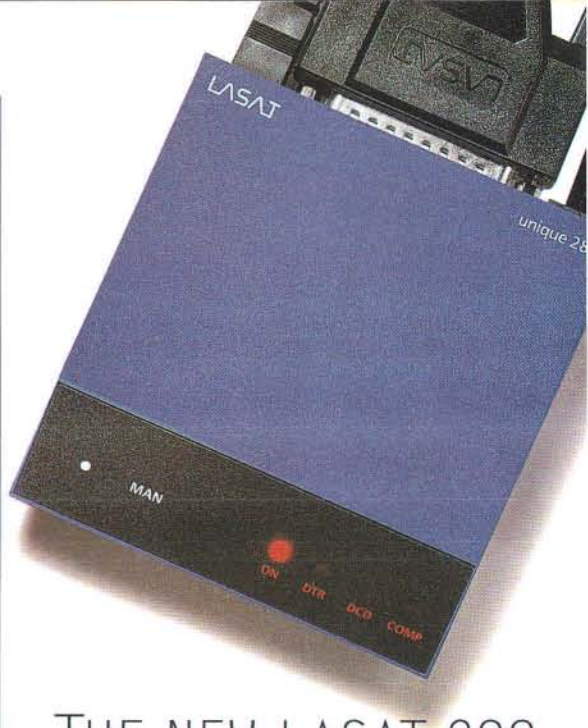
care, as a parent, crime victim or householder, you can now see how good your local service is compared with the rest of the country.

There are of course dangers. The measures picked could be meaningless, or the returns massaged (although the Audit Commission seems to have addressed both these issues). The media and public might interpret the results simplistically (but that is their legitimate responsibility). They may be apathetic – if so, fair enough, but at least they cannot complain.

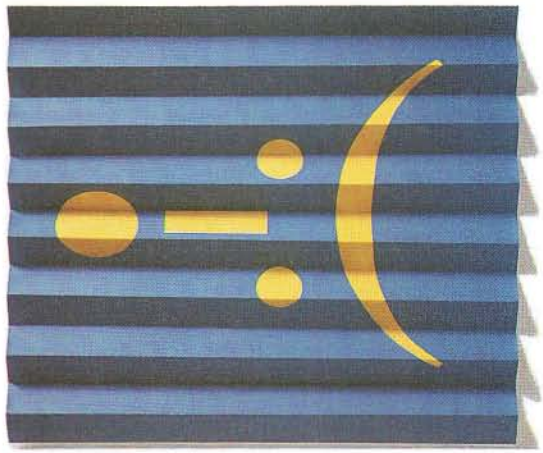
What is significant is that anybody with a spreadsheet program can now produce a more telling analysis of council performance than anyone – including the Prime Minister – has had available in previous years. Add better council financial information (still like blood out of a stone but some is now starting to appear online) and you realise that the debate about technology and democracy is becoming more than just talk.

What the Audit Commission has not – yet – done is to put its data on the Net. Zealous, idealistic, influential, even feared it may be. Wired, however, it is not. – *William Heath*

Local Authority Performance Indicators: from £5. Available from all good booksellers and HMSO: +44 (0171) 873 9090. Disks: £25. IPF Ltd: +44 (0181) 667 1144.



THE NEW LASAT 288 SQUEEZES DATA TIGHTER THAN A FRENCHMAN SQUEEZES HIS ACCORDION



With the LASAT unique 288 modem, Victor Hugo could have sent the whole of The Hunchback of Notre Dame before the bells had time to ring twice. (It is actually possible to send 691 pages of text in less than one minute.) For only £299, the unique 288 gives you the fastest technology available in a case just fractionally bigger than a diskette.

So when you're on the move, you'll find it no trouble to squeeze it into your briefcase. For your local dealer, call 0800 136 331.

LASAT

Price excludes VAT.

File Under "Smile"

I've always told my friends that in the future, the connection between my hard drive and the Internet would become transparent. Data would be so accessible on the global network, any tidbit would be just a click away.

Web browsers come close to this ideal – only you can't send files and information with them. Snatcher comes even closer. In theory, it's an FTP client for the Mac. In reality, it's so easy to use, I hardly know it's there.

The program takes the Mac desktop metaphor and applies it to the once-complex task of transferring files on the Net. Type in an address and Snatcher's files and folders pop up in a

It's a drag – not a chore.

window. Drag a file to your desktop and – hey presto! – you've started a file transfer. Send it to the background and keep working, or queue up other files.

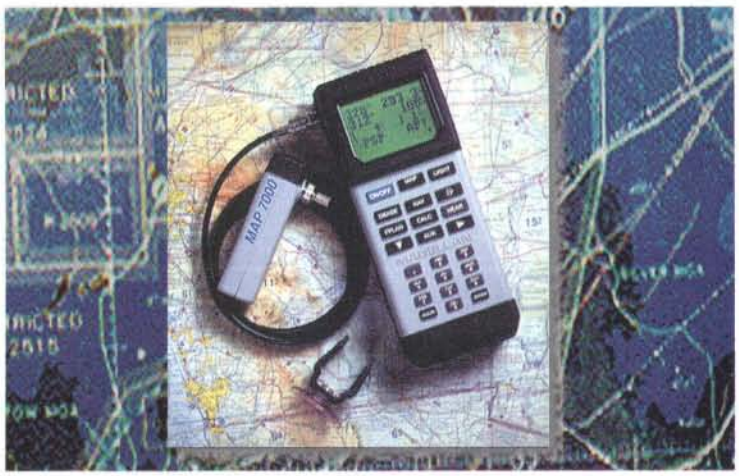
You can finally get rid of that long list of arcane FTP addresses you've been maintaining by making an alias and saving it to your hard drive. I've saved all my friends' and co-workers' public directories; now, sending them files is as easy as dragging and dropping. That old command line is ancient history. – *Jeffrey Veen*

Snatcher: £39.95. Distributed in UK by Computers Unlimited: +44 (0181) 200 8282, fax +44 (0181) 200 3788.

Where in the World?

Picture the scene. I'm 3,000 feet over Somerset and Air Traffic Control, bless them, want to know exactly where I am. Bit of a problem, that. It's one of those days when the weather's not bad on the ground but at 3,000 feet conditions conspire so you can barely see the legal distance. In any case, the fields below are devoid of any type of navigable landmark. Stuck? No, because I have this nifty bit of kit called a Global Positioning System receiver (GPS for short). It says I'm 2.7 nautical miles at 084 degrees from Lower Wimplebush, so I tell ATC and they scratch their heads, go look for a map and wish they hadn't asked.

Slowly but surely, GPS is revolutionising civilian navigation. Originally developed for the US Army post-Vietnam, so that the infantry would know where they were and who they were shooting at, it's been taken up for a whole host of other applications. Up there is a "constellation" of 24 satellites (plus four spares) in fixed orbit; your GPS unit "acquires" the four of these that it can get the best reading from, works out how far it is from each, triangulates the information then tells you exactly where you are.



The Global Positioning System – currently residing in the "Where Am I Now?" file.

Depending on what you're using it for, your GPS unit will have software and databases tweaked to sailing, hiking, surveying, driving, transport monitoring, missile guidance systems – or whatever. It's not that effective within buildings, but men in particular (given their genetic inability to ask for directions) should appreciate the facility to get a fix on their location (accurate to within 100 metres) wherever in the world they happen to be.

In the old days (last year) GPS displays were generally text only. Nowadays you can expect to get moving maps as standard, showing your immediate surroundings, too. Aviation is still wary of the technology (because if it malfunctions in the air you may not be that far from the side of a mountain or the approach path to Heathrow, both of which are places that you don't want to be without guidance), but its progress seems inevitable. For under £500 you can start taking advantage of what Tomorrow's World still coyly refers to as "advanced satellite positioning" – and that has to be good value. – *Martin Le Poidevin*

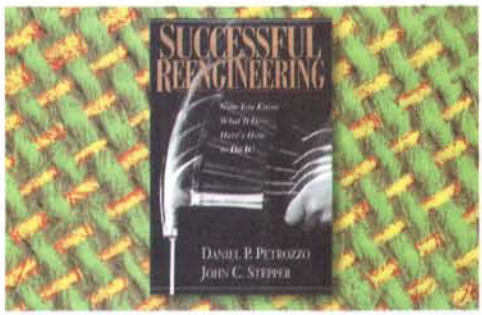
Magellan Skyblazer hand-held GPS locators: from £450. Magellan: +44 (01722) 410 800.

Re-engineer Without Tears

The widespread practice of re-engineering long-established business processes from scratch, usually with the aid of information technology, has probably wrecked more lives than any business fashion since the reign of the numbers-oriented financial whizz-kids of the '50s. Even re-engineering's best-known prophets will remind you that most re-engineering projects fail. One problem is that these prophets have offered little concrete guidance for would-be re-engineers. Daniel Petrozzo and John Stepper's *Successful Reengineering* promises to change this by providing step-by-step instructions.

Most people will find this book useful only as a cultural artifact from the strange world of industrial automation. It presumes that you're up-to-date on the jargon and debates of that world and it makes no pretence of drawing the stuff together in a coherent conceptual framework.

What the authors *do* provide is a batch of small details that nobody could make up without having been there, such as the danger of conflict among partisans of various software-development tools. They also insist that every reengineering team needs



It's one way of updating your company, but is it the right one?

a public relations manager to spread the gospel and quell dissent.

Yet beneath this, Petrozzo and Stepper's book shows that the whole idea of re-engineering is not a new one. Core ideas for mapping and redesigning work processes are essentially what systems analysts started doing decades ago: treating organisations as assembly lines, people as component parts of a machine, and themselves as the minds behind the One Best Way to arrange work organisations. Their methods presume that we live in a wired world where everyone has a computer and access to the Net, but they exhibit no concept of the power of putting people online.

The world presented by Petrozzo and Stepper has little room for change, little use for empowerment and little respect for the capacity of intelligent people to organise their work for themselves. We can do better than that, and we can do it without the mayhem that re-engineering so routinely brings to people's lives. – *Phil Agre*

Successful Reengineering, by Daniel P Petrozzo and John C Stepper: £18.99. Thompson Publishing: +44 (01264) 342 706.

Running the Show

Circus! is a graceful and amusing CD-ROM simulation of an intimate one-ring circus that feels like a TV cartoon under your control.

Aided by an appealing ringmaster mouse named Zippy, children (ages 3 and up) can pick from eight animated circus acts. A fancy dress parade and the trapeze seem to appeal to children who like fantasy and role-playing, while the human cannonball and lion acts draw those who enjoy making judgements about spatial relationships and playing in competition.

It's easy to make trapeze artists miss each other in

Send in the clowns!

midair or accidentally shoot cannonball clowns out of the tent. But if a child doesn't fully figure out an act, he or she never truly gets stuck – after a while, the routine gently concludes.

The traditional animation techniques and character voices are superb, but the original songs may echo through your head for longer than you'd wish. *Circus!* offers a gentle alternative to the obsessive level-hopping that dominates interactive games for children. – *Jim Gasperini*

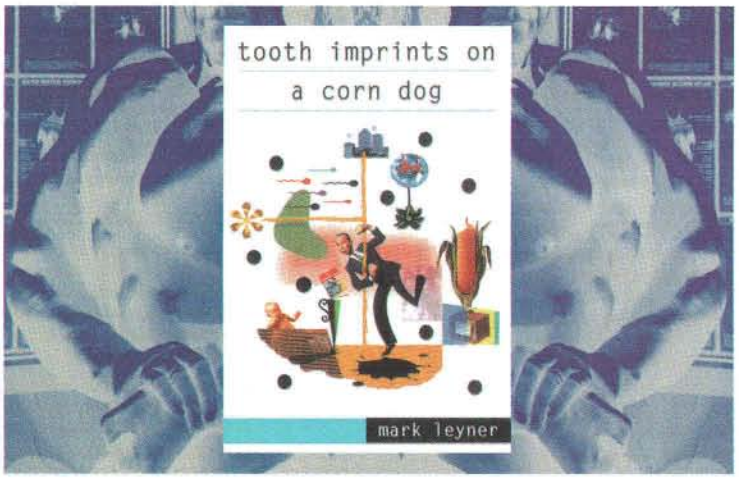
Circus! Mac and PC: £39.99. Published by Voyager, distributed by Softline: +44 (0181) 401 1234.

Dentally Disturbed

The fact that überauthor Mark Leyner's new book isn't as good as his previous meisterwork *Et Tu, Babe* (reviewed in *Wired* 1.01, p99) comes as a surprise to absolutely no-one. Anyone who's read his torrid tale of pharmaceutical advertising copy, steroid-assisted body building and outrageous megalomania will have realised that although he may be "the most intense and, in a certain sense, the most significant young prose writer in America," his parody of writing and writers, of self and cross-referential subjects, was so self-obsessed and overblown that he could never top it. Effectively, he'd burned out too early.

Tooth Imprints On a Corn Dog is ever-so-slightly more down-to-earth. Gone is his tempestous Hispanic girlfriend, replaced by Merci, his marginally more believable wife. The post-'Babe' Leyner's a dad now – a fact he mentions at every opportunity – and with parenthood comes a commitment to behaving properly and actually writing about something for a change.

The result is a collection of the bizarre and somewhat less so. For every hyper-inflated topic (his bathysphere 11 kilometres down in the Mariana Trench or the sinister intervention of Mossad in some of the great works of English literature), there are some chapters that sound credible and almost like real journalism. That sperm bank on the 71st



It's not as good as Leyner's previous book, *Et Tu, Babe*. But then again, what is?

floor of the Empire State Building in chapter 10 just might exist, after all.

It's a patchy collection of shorts and features that sit comfortably together while at the same time having no real cohesive link through them. The teenagers kidnapping an English nanny after watching Mary Poppins and the pampered brothers killing their parents are fairly obvious (but funny) parodies of recent media-hyped stories, but others such as the play set within a department store or the feature urging recent dads to stay mean are pure invention. It's not even a totally comprehensive collection of his recent work – the Keith Richards interview from *Spin* magazine is nowhere to be seen – and maybe he's trying to be clever by introducing Angioplasty Barbie (the tiny doll who scours blocked arteries) but he used that gag in *Et Tu, Babe*. Self-referential, or just short on ideas? I wonder.

Where Leyner succeeds, he does so incredibly and in a style that's easy to mimic (I try all the time) but hard to get right. Stories within stories open like Russian dolls as characters recount more and more outlandish tales, and while the version I got was missing the dust-cover, it's bound to say something like "Synapse-frying, epilepsy-inducing, post-MTV reportage for the jilted generation." It's that kind of book. – *Abe Froman*

Tooth Imprints On a Corn Dog, by Mark Leyner: £15.95. Published by Harmony Books, available in UK from Compendium: +44 (0171) 485 8944.

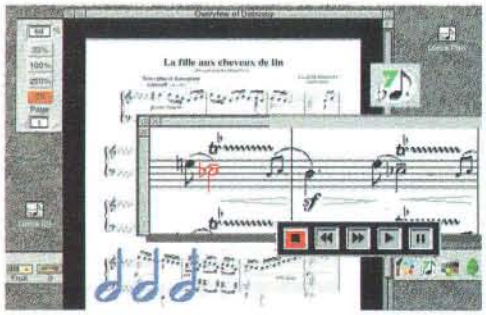
Finnished Symphonies

If QuarkXPress had a musical cousin who took a lot of steroids, the result might be something like Sibelius 7. Named after the Finnish composer of the same name, it's a music publishing program written by brothers Ben and Jonathan Finn (who aren't, however, Finnish) at their home in Cambridge.

You can enter music using a combination of computer or MIDI keyboards, choosing from a full range of expression marks and symbols including the strangest notational excesses of contemporary music. Sibelius really belts along, updating its complex graphical display far faster than many word processors can redraw mere text, and producing a full score and individual parts in finest PostScript.

Sibelius can also play back music via MIDI and recently performed to a packed concert hall as part of a music festival at the Royal Academy of Music. The set consisted entirely of the works of eminent Hungarian Composer György Ligeti, whose piano works are notoriously difficult. According to one pianist, "you need three or five hands to play Ligeti."

As a result Ligeti's works are only ever performed



Sibelius plays piano pieces that are far beyond human ability.

by a handful of pianists and at a fraction of the speed that Ligeti intended. Then someone (my brother actually, a keen Sibelius user) realised that the combination of Sibelius' score-reading facility and the Academy's fully MIDI-ed up concert grand piano would enable the works to be heard as the composer intended. So a computer, wearing a bow tie, ended up performing two Ligeti *Études* to a rapturous audience, including the composer himself.

But, like most other world-beating home-brewed British products, Sibelius has a fatal flaw preventing it from achieving the global domination it deserves: it only runs on British-made Acorn RiscPC and Archimedes machines. And since it's the combination of raw machine code and the RISC processor that makes Sibelius so fast, the prospects of it appearing for other platforms look bleak. Oh, well. Another entry for the list of great British products that never quite made it? File it with the Sinclair Zike and HOTOL. – *Tom Standage*

Sibelius 7: £795. Sibelius Software: +44 (01223) 302 765, e-mail *info@sibelius.demon.co.uk*.

Sonic Cathedral *with Ross Jones*

	Nyack 11 Track Player *(Echo)*	The Young Gods Only Heaven *(Play It Again Sam)*	Various London Jazz Classics 3 *(Soul Jazz)*	A.P.E. Striplight *(Dorado)*	The Ramones Adios Amigos *(Chrysalis)*	Various Em:t 2295 *(Em:t/Time Recording)*	D'Angelo Brown Sugar *(Cooltempo)*	The Chemical Brothers Exit Planet Dust *(Junior Boys Own/Virgin)*	Whigfield Whigfield *(Systematic/ London)*
Who?	*Anglo-American grungers ostensibly from Nyack, up-state New York*	*Three-piece Swiss arch-industrialists*	*Independently produced rump-shakers from every corner of the world*	*Filmic avant-garde beatmakers Adrian Corker and Paul Conboy*	*Prototype snotty punk-rockers, now 20 years old*	*The latest collection from the ambient arm of Nottingham's Time Recording*	*21-year-old Californian multi-soul singer and instrumentalist*	*Tom Rowlads and Ed Simons, the heavy-duty remix/production/DJ unit formerly known as The Dust Brothers*	*Danish ex-model and chart-topping disco bunny*
Interesting fact	*On the CD-Rom included with this album, we learn that Nyack's Craig and Kim used to run an ice cream van, and would often empty trash over the heads of juvenile customers*	*Don't let your ears deceive you – absolutely no guitars were used in the making of this record*	*Brazillian samba artist Papette has released three albums under the banner of Discos Marcos Pereira, for the president's suicidal son, Marcos*	*A.P.E.'s label originally claimed that they were from Texas and were discovered busking in New York. They're actually from Sheffield*	*Dee Dee Ramone didn't let a little thing like no longer being in the band due to "illness" and unsuitable haircut stop him from writing most of this album*	*All Em:t recordings are "spatially expanded" with Roland Sound Space 3-D sound imaging equipment, so expect the unexpected – it's promised that these records will "reward the careful listener"*	*D'Angelo cut his showbiz teeth on the school talent showcase circuit with a band somewhat inexplicably called Michael Archer and Precise*	*The Brothers had to change their name to placate some American Dust Brothers, West Coast hip hop producers responsible for Young MC and Tone Loc, not to mention the Beastie Boys' finest work, Paul's Boutique*	*Like all perfectly-formed people, Whigfield virtually lives on chocolate, and it's not unusual for her to start the day with an all-cocoa breakfast*
Key terms	*Cracking the plaster in Dad's garage, slacking as a waiter in an expresso bar, 11 ways to woo a girl with pierced eyebrows, dawn of Creation, Winona forever*	*Festering, Teutonic, back-projections of disused smelting works, if the medieval had microchips, is it Armageddon yet?, such a clean country, too*	*Juicy, mosquito net, saxual abuse, hot fusion, fun with a wobble board, crowded sweat-shop in the favelas*	*Smoky, spacious, beatheads come out at night, Horlicks hip hop, miniscule attack, Morricone on the Technics at Birdland*	*1-2-3-hey!, too drunk to punk, kids today, grandpa Simpson on L-Dopa, still got it, eh? Eh?*	*Michael Nyman wrapped in cotton wool, whale tango, foetal heartbeat, the beat is out there, behind you!*	*If molasses could sing, candlelight funk, walking in a boogie wonderland, dad's record collection, My – what big brown thighs you've got*	*Beats working, rhino in a recording studio, funky jackhammer, so that's what slipmats are for, the Bomb Squad's unused Robocop soundtrack*	*Effervescent, bubbly, pidgin pop, trainee hairdressers' Ritzy night out, strobelight honey, mascara-streaked*
Loop it	*Lost In You, Savage Smile, I'm Your Star*	*Kissing The Sun*	*Donna McGhee, Mr Blindman, Tony Esposito, L'Eroe Di Plastica*	*Fallen, Striplight*	*The Crusher*	*Woob, Fourteen Thirtythree, P-Eye-Eye, Lost At Sea*	*Cruisin', Shit, Damn, Motherfucker*	*Until your corpuscles triple in size*	*Think Of You, Ain't It Blue, Saturday Night*
Skip it	*Summer Sleeper, I Remember Red*	*Moon Revolutions parts one, two and three*	*Hannibal, Mother's Land*	*Piecemeal*	*While you've still got the memories*	*Thomas Köner, Subnival, Bad Data, So Many People*	*Me And Those Dreaming Eyes Of Mine*	*Alive:Alone*	*Don't Walk Away*
Now try...	*Dinosaur Jr, Seven Day Diary, My Bloody Valentine, not admiring them for putting an Atari 2600 on the sleeve*	*Front 242, Throbbing Gristle, Cassandra Complex, retaining any respect you might've had for Trent Reznor*	*Esperanto, Mtumbe, David Byrne, Tito Puente, Perez Prado, pretty much anyone whose name ends in "io"*	*Barry Adanmson, UFO, Cool Breeze, Ry Cooder*	*Tenpole Tudor, DOA, Green Jelly, Ugly Kid Joe(y)*	*Divination, Aural Expansions, Art Of Noise interludes, sleeping alone*	*Rick James, Tony! Tone! Toni!, Portrait, producing a bottle of wine at an unexpected moment*	*Depth Charge, Mantronix, Sam Sever, dancing in a garbage compacter*	*Corona, Felix, Rob & Raz, Betty Boo, Technotronic, hiring a bouncy castle*

Microwave o' the Month

Pink Floyd

Pulse

(EMI)

A lavishly-packaged souvenir of the out-there octagenarians' last tour, with the multi-million-pound light-show replaced by a single red LED light on the side of the case. Nice try, but it's not enough.

MUSIC ACCESS

If you'd like to hear excerpts from these discs,

☎

call (0839) 363 738

(Calls charged at 39p per minute cheap rate, 49p per minute at all other times)

Touch tone required. UK only. Under 18s – please ask the permission of the person who pays the phone bill.

When prompted, enter appropriate access code (shown below).

Press * to exit music and bypass prompts. Listen for details of other controls.

A charge of 39p per minute (cheap rate) or 49p per minute (all other times) will appear on your phone bill. Music Access samples for reviews in this issue are active June 16, 1995 – July 20, 1995.

In the table below, you'll find a single-digit code for each album. To hear sample tracks, dial the 0839 number above, entering the code when prompted. You'll hear up to three minutes of music. To leave the music, or bypass the prompts, press *.

Code	Artist and Title
1	Nyack, *11 Track Player*
2	The Young Gods, *Only Heaven*
3	Various, *London Jazz Classics 3*
4	A.P.E., *Striplight*
5	The Ramones, *Adios Amigos*
6	Various, *Em:t 2295*
7	D'Angelo, *Brown Sugar*
8	The Chemical Brothers, *Exit Planet Dust*
9	Whigfield, *Whigfield*

Breaking the Code

The US National Cryptologic Museum is almost as notable for what it doesn't depict as for what it does. Less than a mile from the National Security Agency in Washington, DC, the museum offers a fascinating but sanitised peek into the NSA's double mission of protecting US military communications while intercepting everyone else's.

The museum's small, eclectic collection includes devices such as the Civil War-era "wig-wag" crypto system and Confederate cypher wheels, both used to send secure messages from battlefields; a World War I radio-interception station for listening to behind-the-lines German communications; and a large electromechanical rotor machine built during World War II to decrypt Japanese diplomatic ciphers. A larger exhibit recounts some of the military's most successful cryptographers: Native American "code talkers", whose tribal languages were unintelligible to the enemy.

In the back of the museum is a copy of a 2-foot wooden seal of the United States of America, allegedly carved by Soviet school children and given to US Ambassador Averell Harriman in 1946. The ambassador was so taken with the seal that he hung it in his office; six years later, a routine

Strangely, they don't sell the public domain version of PGP at the souvenir shop.

security sweep discovered a hidden microphone inside the wood that the Soviets had used to eavesdrop on the ambassador's conversations.

But the best exhibit at the museum is the collection of 13 German Enigma machines, the standard military cipher used by Hitler during World War II. Not only do the machines work, but you can use them to encrypt and decode secret messages. To try one yourself, set the code wheels to 10-10-10, type in your message and watch it translate into an unintelligible jumble of letters. If you were to send this communiqué, your collaborator would simply punch in your secret code to read the message.

So, what's missing? Almost every advance in cryptography since the invention of computers – save an IBM Harvest processor and a Cray supercomputer which faithfully served the code-crackin' NSA from the '60s into the '90s. A secure telephone exhibit is under construction.

But to get the real low-down on the nation's secret ciphers, you'll still have to walk a mile down the road and ask the spooks for a job.
– *Simson L Garfinkel*

National Cryptologic Museum: Admission is free. National Security Agency: +1 (301) 688 5849.

Tanked Up

Curiously, the world's most compelling networked video game isn't *Doom* or *Descent* after all – it's the 2-dimensional top-view AppleTalk strategy war, *Bolo*. You're a tank. You drive round an island exchanging fire with other human players and automated gun turrets. You capture refuelling bases and fortify them by building walls, roads and turrets of your own. There's no limit to how many times you can get blown up – the game only ends when all the other players either run out of resources or sum up sufficient strength to quit back to real life.

Sound dull? It's not. Claiming parentage from an old BBC micro game (and also

Panzers at dawn.

resembling the ZX Spectrum classic *Panzerdrome*), *Bolo* is a frighteningly compulsive way of wasting whole lunch-hours, evenings and weekends. The fanatical players, world-designers and AI tank programmers on the newsgroup *rec.games.bolo* and *#bolo* IRC channel show how easy it is to get drawn in, and reveal the amazing complexities that arise from the interactions of very simple variables. Hey, it won't even cost you a penny to try it – as with all the worst addictions, the first one's always free. – *Dave Green*

Bolo for Mac: freeware. Downloadable from *ftp://bolo.stanford.edu*.

MICROWAVED CD: LISA SEAMAN

Straight Out of the Jungle

Beaming onto TV screens across the land is *Phantom 2040*, a wild futuristic twist on the original Lee Falk comic that has been running in newspapers for more than 50 years. Masquerading as just another laser-shootin', Spandex-sportin', superhero cartoon, *2040* is a brilliant animated rendition of a futuristic dystopia.

Taking the classic hero from his jungle roots and throwing him into the future, the story arc has 18-year-old biology student Kit Walker Jr stepping into his dead father's

The non-toxic avenger.

shoes and fulfilling the family destiny by becoming the 24th Phantom. Yet unlike the Phantom of old, a warrior in the heart of the African jungle, this Phantom's battle is to preserve biodiversity and stop the growth of Cyberville, pet project of evil corporate overlord Maximum Inc.

2040 presents a convincing vision of a world in which natural resources have lost out to technology. Not simply another merchandising scam, it's spectacularly written with smart dialogue, an intricate story line and animation to match. – *Todd Krieger*

Phantom 2040: Produced by Hearst Entertainment, shown on Sky One, 11am, Saturdays.

Lotus *Ésprit de Corps*

Advertising agencies aren't renowned for being successful frontiersmen of much more than the world of recreational hallucinogenics. Let's face it, Luddites and agency suits all shop at the same tailors. In the past, the problem used to be that everyone's just-too-busy-dahling to learn about all those computer thingies.

In fairness that was a couple of years ago. How times change. Take the Lotus Notes implementation that our agency committed to in 1992 (dark ages, for sure, but that's when Notes arrived). It affected us in more ways than we expected.

Certainly it helped us share information – it helped us track work, customer contacts, you name it. Each of our clients has their details, staff, contact reports, research data, status reports, correspondence, creative copy – and soon, visuals and video – accessible from one icon. Employees out in the field (and that can mean anywhere in the US or Europe) can dial in and immediately see updates on discussions, new reports, letters and phone conversations. Try doing that with e-mail.

But more than this, Notes bizarrely created its own personality and drove that personality through the agency. And this came about through the Usenet-like discussion forums.

For keeping in touch within an organisation, Notes is even better than e-mail.

All information in the company is now shared to a greater or lesser extent. (I've come to believe that information which isn't shared becomes an obsolete overhead). Most forums are open to everyone in the agency to encourage internal *glasnost*. The discussions range from the specific (new business pitches) to the general (these evolve into wonderful hybrids of industry tracking, market information, hot news, evil gossip and gut-busting repartee). All benefit from being open as different disciplines can add their way of thinking to problem solving.

The Board also has a forum for issue debating, financial reports and all the boring sort of stuff you'd expect to be done behind closed doors. The great thing about Notes is the security which allows us to run this side by side with open-access forums and not lose any sleep.

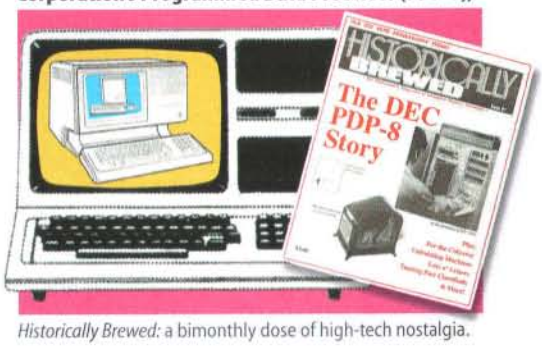
Notes has the opportunity to do for networked computing what Windows did for standalone PCs. The trouble is that Lotus needs to get focused or aggressive with its marketing, rather than struggling with its outmoded desktop software like AmiPro and 1-2-3. In the long term they should become "Notes – The Company" and build a huge array of apps around it just as Microsoft has done for Windows. Will they do it? Maybe they'll be forced into it because the rest of the house is rapidly burning down around them. – *Alex Letts*

Lotus Notes Starter Pack: from £795. Lotus Customer Services: +44 (01784) 445 808.

Calculating Nostalgia

When my mother phoned last summer to remind me that the family yard sale was approaching, I knew what she was after. She wanted my Commodore 128. I swallowed hard. My 128 had helped me create extra-wide margins on more term papers than I could count and my brother and I cemented our relationship playing *Blue Max* and *4th and Inches*. No matter. After much gnashing of teeth, my mother declared that I was too sentimental and sold the machine for 50 bucks. So, when I stumbled across *Historically Brewed* a few months later, I could relate to its devotion to outdated technology.

***Historically Brewed* caters to serious collectors of displaced workstations and microcomputers, appealing to both the geek and the pack rat in us all. Although its prose does get a bit thick with data and dimensions, it provides a refreshing change to the constant prattle about upgrades in other computer mags. An article in Issue 7 details the rise (the fall comes in a later installment) of Digital Equipment Corporation's Programmed Data Processor (PDP-8),**



Historically Brewed: a bimonthly dose of high-tech nostalgia.

an early minicomputer deemed wildly successful after Digital sold 1,200 of them during the late '60s. Then came the PDP-8/S, the first cash-and-carry desktop computer, which spawned clones galore and eventually led to the PC revolution.

What saves *Historically Brewed* from being just another boring computer-history journal is its audience. The letters page is a great read, if only because it's nice to know there are others – in this case, college professors and retired technicians – who believe that the sum of a computer is greater than 0 and 1. There's the usual feisty but good-natured dissent as well. One reader argues that the Macintosh Model 0001 (available for US$500 in the Trading Post) pushed "interface fascism" because it didn't have cursor keys, forcing you to handle the mouse; another relates that many reporters at small Kentucky newspapers still swear by their Tandy 100s, forcing newsrooms to use only 300-baud modems as a result.

And my mother thought I was too sentimental! – *Chip Rowe*

Historically Brewed international subscription: US$22 for six issues. +1 (904) 384 7163, e-mail: *historical@aol.com*.

The Final Frontier?

In 1984, a humble computer program known as *Elite* gave games-players a glimpse of the universe. In 1993, the sequel – *Frontier* – continued the theme of intergalactic space-trading, improving on the original's wireframe 3D graphics, but also throwing in a number of bugs and quirks. Now, *Frontier: First Encounters* offers an updated, all-singing, all-dancing version. The premise remains faithful to the original: here's a spaceship, here's some money – go explore the universe.

The player can forge their living by riding the trade routes, ambushing innocent merchants, hunting down ruthless pirates... the list scrolls on. FFE even sports a

Mostly bugless?

new graphics engine. The planets have cliffs, beaches and mountain ranges. You even get people popping up and talking to you while you sit in dock. Admittedly, the production values here are abysmal. Still, you can always turn them off.

The bugs, however, are still there too. There is a patch available that fixes most of the major problems (available from Gametek themselves, or ask nicely on *alt.fan.elite*). But it's been 11 years since Elite first came out – you'd think they'd have got it right by now. – *Mark Stevens*

Frontier: First Encounters for PC: £44.99 (CD or floppy). Published by Gametek UK Ltd: +44 (01753) 553 445.

1. Neo-Luddism (was: Internet Backlash)

Resisting technology in the face of an overwhelming digital revolution may be noble, but it sure seems futile. Even the most eloquent Neo-Luddites – from Sven Birkerts to Theodore Roszak – admit their attitudes are quixotic. It's this rhetorical tactic that makes them hard to assail. How can you contend with someone who agrees that his or her position is hopeless from the start? But, finally, this acquiescence makes their arguments irrelevant. In fact, *Wired* has a sneaking suspicion that the real Neo-Luddites are engineers working undercover in Silicon Valley. How else can you explain the constant stream of bug-ridden and hard-to-use products being released?

2. Net Security

You probably assumed that as the Net became more commonplace and as the electronic frontier became the electronic office, media hype about hackers would disappear – they'd be no more intriguing than teenage shoplifters. Yet, despite the media's increasing Net savvy, hackers remain front-page material. The public's fascination with hackers doesn't seem to stem from a prurient interest in the forbidden, but from sheer awe of people who travel freely and effortlessly in the digital realm. Hackers are becoming 20th-century mystics, capable of understanding and manipulating a secret world that confounds the rest of us.

	Current Position	Position Last Month	Months on List
Neo-Luddism	1	–	RE
Net Security	2	1	2
Sci-fi Revival	3	–	1
Microsoft Network	4	–	1
Multiuser Games	5	–	1

HYPE LIST

3. Sci-fi Revival

Jointly inspired by the approaching end of the millenium and the runaway ratings figures garnered by *The X-Files*, the viewing public are rekindling their interest in good old-fashioned science fiction. But on the strength of most of the newer offerings (*Deep Space Nine, Space Precinct, The Outer Limits*) it seems that sci-fi still means inevitable dumb costumes, flat characterisation and appalling dialogue. Sadly, if there's one thing these producers haven't learned from the 1970s, it's that nothing dates more quickly than a vision of the future.

4. The Microsoft Network

The imminent launch of the Microsoft Network has the Internet community mesmerised. Every Microsoft announcement is microscopically analysed for hints of what's to come. There is no doubt that the network will profoundly change the culture of the Net, but the changes will have less to do with Microsoft policy on, say, acceptable content than with the underlying technology. The Net is closely related to Unix, and the two share similar characteristics: both are hard to use, buggy and insecure. But they are also easy to change, flexible and egalitarian – traits that have nourished the Net community. The question now is: what sort of culture will Microsoft promote?

5. Multiuser Games

William Gibson came up with the notion of cyberspace while watching teenagers mesmerised by the flickering displays of videogames. It's an image that seems increasingly prescient. From CompuServe's *WorldsAway* to id Software's *Quake*, there has been a spate of recent announcements about online multiuser games. These systems will act as electronic theme parks that allow players across the globe to interact within a graphical environment. The prospect of a visually richer online world is enticing and seems likely to catch on quickly, first for games and then for more sober business applications. Yet there is something repellent about the thought of working in a world designed by Sega and Nintendo.

– Steve G Steinberg/Dave Green

Street Cred Contributors

Phil Agre teaches communication at the University of California, San Diego, and edits *The Network Observer* at *http://communication.ucsd .edu/pagre/tno.html*.

Ivan Berger, technical editor of *Audio Magazine*, has been writing about audio and other aspects of electronics since 1962. As an Altair owner in 1976, he was one of the first with a home computer.

Stuart Campbell was the UK's 1988 National Computer Games Champion and a member of the winning team in the 1990 European Video Games Championship. Go figure.

Brian Eno lives in London and is a patron of War Child, an organisation working with traumatised children in former Yugoslavia.

Abe Froman plays videogames instead of working on film and television scripts. He *still* hasn't got past page 30 of his forthcoming meisterwork, *7 Days In June*.

Jim Gasperini *(jimg@well.com)* is collaborating with Tennessee Dixon on *ScruTiny in the Great Round*, a CD-ROM work of art about sex and procreation.

Simson L Garfinkel *(simsong@mit.edu)* writes about science and technology from his electronic house in Cambridgeport, Massachussetts. These days, he's trying to make a living from hating Unix.

Dave Green *(dgreen@wired.co.uk)* invented the Internet meme "20 things that never happen in *Star Trek*" over five years ago and still hasn't received a penny for it.

Simon Green *(si@reality.dungeon.com)* is a professional games programmer, and author of the shareware classic *Extreme Violence*. You'll find his webzine at *http://www.dungeon.com/~globe*.

Corey Greenberg is technical editor of *Home Theater Technology* magazine. He has not a single kind bone in his body, yet all the ladies call him "Lovin' Daddy."

William Heath *(william@kable.demon.co.uk)* used to be a mediocre electro glam-rocker, but is now a partner in Kable, a firm specialising in public-sector IT research and publications.

Chris Hudak *(gametheory@aol.com)*. Fiction/tech/travel writer. Long hair. Shoots pool. Borderline alcoholic. Attitude out to here. Lucky as hell. Likes Wile E Coyote, Disneyland and Death.

Ross Jones *(guide@cityscape.co.uk)* is music critic at the *Guardian Guide*. His colleagues variously describe him as a "Swarthy outdoorsman", an "Impish marmoset" and "Cute as a button. Maybe cuter."

Todd Krieger *(tkrieg@sirius.com)* is a reluctant nomad in search of the perfect chili dog.

Martin Le Poidevin *(100566.2404@compuserve.com)* is editor of the civil aviation magazine, *Flyer*.

Robert Leedham *(rleedham@wired.co.uk)* is features editor of *Wired* and part of the *Guardian's* Product Development Unit. He has never divulged his PIN number to anyone.

Alex Letts *(alex.smi_group_limited@notes.compuserve.com)* is chairman of the new-tech advertising agency, SMI. Sadly, Lotus is not one of their clients.

Dan O'Brien *(danny@wired.co.uk)*. mutters secret IP addresses in his sleep, then shouts "K'Plagh!" at strangers who pass him on his way to work the next morning.

Chip Rowe *(chip@playboy.com)* is an assistant editor at *Playboy* magazine and chief honcho of *Chip's Closet Cleaner*.

Tom Standage *(thomas@primrose.demon.co.uk)* is a technology writer who lives in Primrose Hill, London. He is the least musical member of his family.

Steve G Steinberg *(tek@well.sf.ca.us)* is a computer science student and the editor of *Intertek*, a technology and society journal.

Mark Stevens *(mark@sonance.demon.co.uk)* writes ambient music under the name "Sonance" and co-produced most of the tracks on the compilation album *Trance Trippin'* (Jumpin' & Pumpin' records).

Rogier van Bakel *(rogiernl@aol.com)*, as anagram enthusiasts will note, has Brave Ink Galore. He is a Dutch correspondent in Sharon, Connecticut.

Jeffrey Veen *(jeff@hotwired.com)* is HotWired's Interface Architect – a title he made up all by himself.

Headed to AST?

Denmark needs a good PR firm. Seriously, what does *Denmark* bring to mind? Vikings? It's just not '90s. What about *Danish*? A sticky pastry, right? But, with the right PR, you might think: Denmark – peaceful, picturesque and not as pricey as Scandinavia proper! Composed of the Jutland peninsula and more than 400 islands, the country is a hauntingly beautiful world of Renaissance castles and quiet fishing villages, Viking legend and fairy tales.

The capital city of Copenhagen, located on the largest island, Zealand, has a bigger image problem than Denmark, which advertises itself with a mermaid on a rock where other cities have, say, an Eiffel tower. Nonetheless, this city of medieval churches and modern clubs will impress even the most jaded junketeers.

Wander the winding back streets of the inner city (Indre By) and stroll down the Strøget, a cobblestoned pedestrian boulevard lined with shops and cafes, stopping at **Chokoland** for a taste of the local liquorice. When your feet are fatigued, snag a seat in the sun at the **Café Europa**, on Amagertorv and do a little low-tech surveillance of Copenhagen culture.

Further down the Strøget lies **Tivoli Gardens,** the grande dame of amusement parks, with its old wooden roller coaster and regular firework displays. More amused by art? Amble over to the **The Museum of Decorative Art** (Kunstindustrimuseet) on Bredgade to see their exhibition of 20th-century Danish furniture design. Modern art lovers should also make the hike to Humlebæk, to visit the **Louisiana Museum**, an impressive collection of modern art housed in a 19th-century villa by the sea.

When your stomach summons, dine à la Danish at the traditional **Cap Horn**. Take a slice of brown bread and pile that *smørrebrød* high with marinated herring, liverwurst, meats and cheese. For a light lunch or a cool Carlsberg in the inner city, choose **Café Sommersko**, a popular destination during the day and after dark. Or opt for **Café Dan Turrell**, a social spot packed with unstudious students in the evenings.

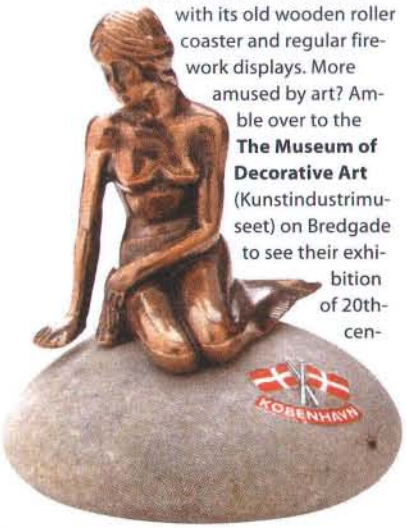
The Danes delight in jazz, or at least the cosmopolitan Copenhageners do. Stop by the **Montmartre**, the city's major jazz venue, or the **Copenhagen Jazz House**, a Cinderella jazz joint, which turns into a disco at midnight.

Though you won't find much rotten in the city of Copenhagen, take the train north to Helsingør to visit **Kronborg Slot**, said to be the site of Hamlet's Elsinore Castle. Shakespeare never visited Kronborg, but that hasn't stunted the local *Hamlet* souvenir industry.

It's truly a trek, but anyone who's played with those colourful plastic bricks should visit **Legoland Park**, built with more than 38 million Legos, in Billund on the peninsula.

More than enough Denmark data? Just one final fact: early in the Nazi occupation, the Danes smuggled 7,000 Jews across the Baltic Sea to Sweden in one night, saving 93 per cent of the Jewish population! Not many countries could pull that off. Truth is, they don't need an Eiffel Tower after all. – *Jessie Scanlon*

Mange tak *to Henriette Mørk, Tonie Olaso-Revon and all the virtual voices without which I would be literally lost.*



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6-7 July Interactive Newspapers Europe; London. Registration £785. Contact: +44 (0181) 943 9700, fax +44 (0181) 943 9997, e-mail *news@hammconf.demon.co.uk*

18-19 July Interactive Multimedia Marketing; London. Registration £695. Contact: +44 (01895) 256 484, fax +44 (01895) 813 095, e-mail *unicom@unicom.demon.co.uk*, Web *http://www.demon.co.uk/unicom*

23-28 July World Conference, Computers in Education '95; Birmingham. Over 400 presentations on everything from Crocodile CDs, frog muscular activity and IT in Katmandu. Registration: £150 full week, £35 two days. Contact: +44 (0121) 428 1258, fax +44 (0121) 428 2246.

The July Round Up (see Wired 1.03)

1-2 July Access All Areas; London • **23-25 July** Spotlight '95; Dana Point, California • **25-29 July** Electronic Imaging and the Visual Arts; London • **27-31 July** Fourth Bath Quinquennial Science Studies Workshop; Bath • **6-11 August** SIGGRAPH '95; Los Angeles.

21-24 August ICCC '95: Information Highways for a smaller world and better living; Seoul, Korea.
The latest research on the latest technologies and issues, social, economic or evolutionary, relating to the Superhighway. All as wholesome as breakfast cereal. Registration: Before 25 July $450/$50 students, then $500/$100. Contact: Dr Seon Jong Chung, +82 (2) 588 9246, fax +82 (2) 521 1352, e-mail *iccc-reg@krnic.net*, Web *http://www.cs.cmu.edu/Web/Groups/scandal/www/conf/cfp-ICCC-950201.txt.*

28 August – 1 September Eurographics 95; Maastricht, Netherlands.
Annual conference of the European Association for Computer Graphics. Registration: NLG1,350-1,550. Contact: +31 (20) 592 4048, fax +31 (20) 592 4199, e-mail *info@eg.org*, Web *http://www.cwi.nl/Eurographics.*

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3-7 September ICMC'95: Digital Playgrounds; Banff, Canada.
It's festival time as musicians gather to play, compare notes and hang out amid the multimedia soundscapes, concerts and virtual audio exhibits. Registration: CAN$530/CAN$260 students. Contact: +1 (403) 762 6669, fax +1 (403) 762 6665, e-mail *icmc95@banffcentre.ab.ca.*

4 September Advanced Surveillance Technologies; Copenhagen.
Spies in your house of love? Presentations on advanced surveillance satellites and microchip implants could be just what you're looking for. Registration: US$175 for organisations, $75 individuals. Contact: +1 (202) 544 9240, fax +1 (202) 547 5482, e-mail *pi@privacy.org.*

6-8 September Information Processing in Cells and Tissues; Liverpool.
IT gets physical looking into info processing in biological and computational systems. Contact: fax +44 (0151) 794 3715, e-mail *tissues@csc.liv.ac.uk*, Web *http://ribble.csc.liv.ac.uk:80/users/biocomp/iphome.htm.*

11-15 September 6th IFIP International Conference on High Performance Networking; Palma de Mallorca, Spain.
Sun, sea and Netsurfing? Gigabit networks, synchronisation and Groupware communication? Your choice. Contact: +34 (71) 173 288, fax +34 (71) 173 003, e-mail *putxi@ps.uib.es*

Out on the range

18-21 September The Asia Pacific WWW conference, Brisbane, Australia. Contact: Leon Tighe, e-mail *ltighe@acslink.net.au*

17-24 September ISEA'95; Montreal. Contact: +1(514) 990 0229, fax +1 (514) 842 7459, e-mail *isea95@er.uqam.ca*, Web *http://isea95.comm.uqam.ca/isea95.html.*

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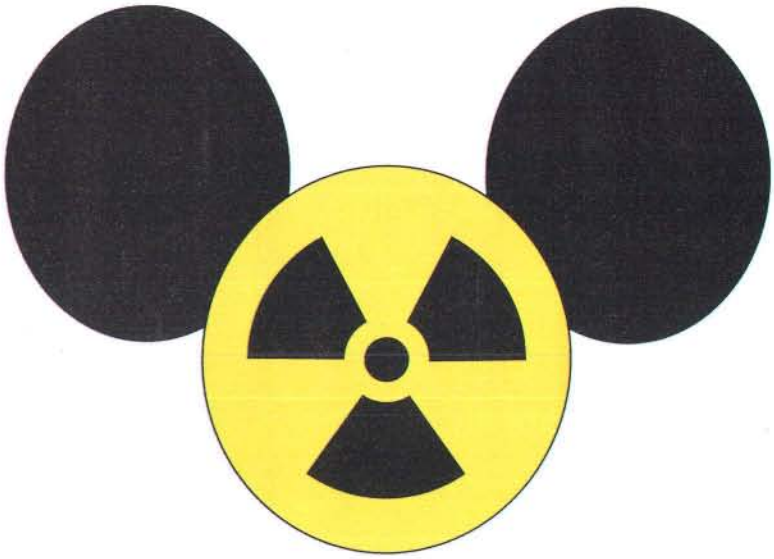

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net surf

Edited by Azeem Azhar

Sesame Superhighway

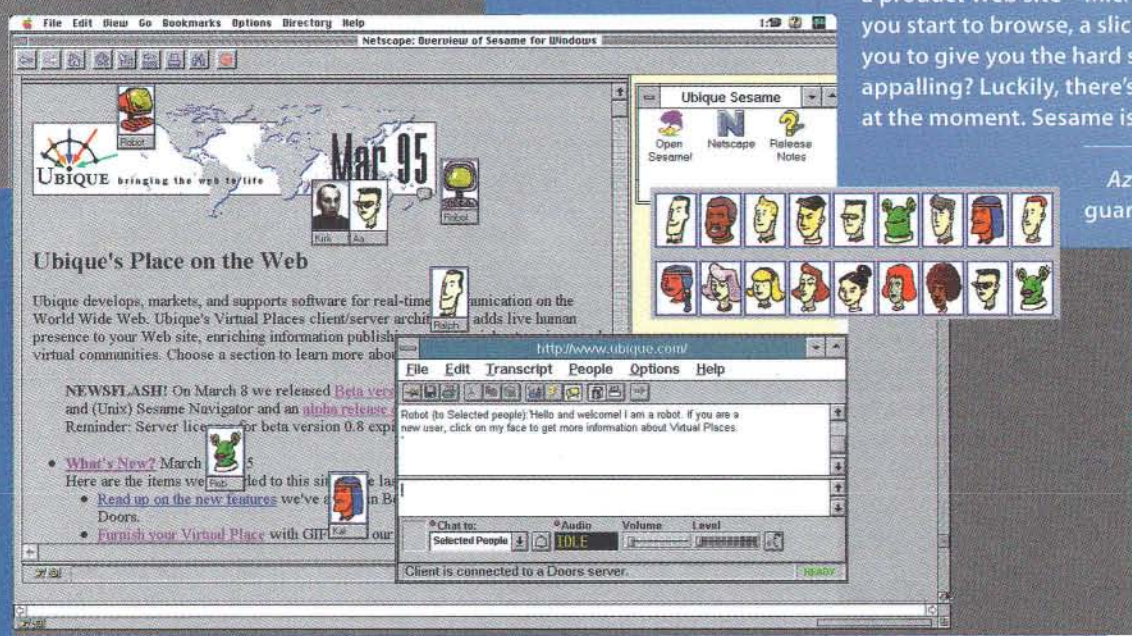
It's a lonely business, surfing the Web. Wherever you are, no matter how cool or interactive, you're on your own. I mean, there could be 20 other people looking at the same site as you, but you'd never know they were there. And if you did know they were there, you wouldn't be able to contact them. Even with every flashy Netscape enhancement, you're still on your own.

But with Ubique's Sesame you don't have to be. Hit the command "Open Sesame" while running Netscape (and the *Arabian Nights* metaphors don't end there) and you can talk to other Net surfers browsing the same site as you. Surf with Sesame and an icon of a true nerd appears on the page you're looking at. That nerd is you. If another Sesame-user looks at that page, their icon (which always seems to be distinctly unnerdy, resembling Paul Newman or Catherine Deneuve) appears floating around the text. Double click on it and presto, the conversation begins. If you've got enough bandwidth (14.4Kbps or more), a soundcard and a mic, you can have an audio conversation. If you're using a duff old PC like mine, you'll have to put up with a keyboard chat.

Even a keyboard chat with another Web user is magical, especially after hours of solo surfing. My first conversation was with surfers from Israel and Canada, both on sleek permanent connections to the Internet. Yet I still managed to keep up with the conversation over my modem line, discussing what we thought of the Ubique Web site, what we did and how great Sesame was.

Keyboard chatting is a poxy pastime compared to what Sesame can really do. Enter the Magic Carpet and the Rocket Ship. Create one of these and you can take your new found mates on a tour of the Web. The Israeli duly volunteered to guide us. We jumped onto his Rocket Ship (by dragging our nerdy icons onto it) and off we went. Once again I managed to keep up with my two companions as we flew across the States, to the Middle East and around Europe. All the while we got a commentary from the impromptu tour guide until, for some reason, I fell off, stranded on an Austrian Web site.

Ubique is pushing Sesame's great business potential. Imagine a product Web site – Microsoft's or IBM's. As soon as you start to browse, a slick company rep leaps on you to give you the hard sell. Doesn't that sound appalling? Luckily, there's not much of that about at the moment. Sesame is great fun.



Azeem Azhar (azeem.azhar@guardian.co.uk) *works on the Guardian's OnLine section. He is trying to kick his Coke addiction.*

Sesame is available from http://www.ubique.com/. *It is available for Sun and Windows platforms and requires Netscape 0.96 or greater. The current release is free.*

Take the bus
Forget writing down long URLs or worrying over where to go next, just a hitch a ride on the Cyberbus and all your problems will be solved. Cyberbus takes you from place to place on the Web and if you see something you like, just tell the driver to pull over. No traffic queues to slow you, no schoolkids to annoy you: get on a Cyberbus tour now and see what you've been missing.

The Garden of Eden
A few well-made Web pages and/or a pretty face can turn ordinary people into celebrities overnight. Eve Andersson is one of these people, a sassy student-cum-alien with a penchant for pi, puzzles and bizarre self-publicity. Her Garden of Eden has spawned worship pages from smitten fans around the world – even before her World Wide Web dating game made an appearance. Have a look, tweak her antennae and see what all the fuss is about.

Digital Reiko

It's hard to work out whether Japanese pop idol Reiko is more reminiscent of self-obsessed Sushi K from *Snow Crash* or is merely an invalid of her own fame. After spending most of her childhood in bed because of illness, she later shot to teen stardom as a kind of digital Kylie, spending hours online each night chatting to fans. Her dream to never again leave the comfort of her e-mail in-tray is about to come true once her spate of flat decorating is over. Her chosen colour scheme: chroma-key blue to provide a special-effects background set for her VR-style remote performances. Is 17-year-old Reiko the Queen of Teleworking?

Experience true devotion by perusing her virtual wardrobe and voting for which outfit she should wear next. One of the new generation of the tech-damaged or just the first virtual pop star?

Nutscape Enhanced
Okay, we love Netscape enhanced pages: the tables, the backgrounds, the push, the pull, the blinking text. But, boy, haven't those bells and whistles created some ugly Web pages? They've also spawned a considerable group of Netizens attacking Mozilla and his extensions for going down the proprietary route to market domination. What do you think? Let Nutscapify bring the glamour of Netscape enhancements to your pages and then decide.

It's that Craze Again
The world is divided between those who glance at Magic Eye pictures for a split-second and say, "Oh, that's the Eiffel Tower" and those who spend an hour going cross-eyed before giving up in disgust.

Since SIRDS (as they're properly known) are computer generated, it's not surprising to find them on the Web. Gareth and Peter's page, at Manchester University, is not particularly pretty, but it's certainly comprehensive, with links guaranteed to either impress you or leave you with a headache.

Electronic *Beowulf*
Beowulf is the first masterpiece of English Literature, with its story of heroism, monsters and mead-halls. The British Museum has had the unique 11th century manuscript digitised, to prevent any further damage inflicted by the dirty hands of researchers.

The result is one of the best uses of multimedia yet seen, combining fibre-optic and ultraviolet manuscript images, transcripts, collations and translations. The 11th century meets the 21st...

Same New World
Weather-beaten Web surfers suffering from mouse finger need not fret. No longer will they have to activate a hyperlink for something to happen on the Web. With Netscape's new one-frame-per-second live-animation facility, the server does the work. It's almost as good as TV. Let go of any ideas you may have about the future of interactive media and help re-establish broadcast media as the basic unit of the consensual hallucination. Visit Southern's animated Web pages for techno band Globo for a taste of the future.

The Sinclair Archive
I still have a Spectrum. Actually, I have three of the things, packed away in my loft. They were once at the cutting edge of computer technology. In 1984. For those old enough to remember – or too young to know any better – try out Chris Owen's Sinclair Archive, a labour of love with histories, pictures, articles and links to Speccy resources around the world.

Your Starter for Ten
It's not the global village, but the global bar quiz. Each week new questions test your knowledge of rock, sport or trivia. Get it right and join the hall of fame… or sink without trace. Know which movie ends with the words "Madness, madness", the lyrics to "What's the Frequency Kenneth?" or the scorers in this year's FA Cup semis? Then you stand a better chance than I do.

Who's Who?
To make it into *Who's Who* in the real world, you've got to do something or be someone. It's not like that on the Net: we've all got the same claim to fame. No entrance qualifications required – they let *me* in.

Helping Hand
Problems, problems. We all have them and Alice can solve them. Run by Columbia University's team of trained counsellors, Alice is an online database of useful – and serious – information. Worried about anorexia? Problems with the girlfriend? Alice can give you all the answers with the right degree of sensitivity: "My little sister is doing coke. What should I do?" Let me tell you the reply wasn't "MDMA".

No Fucking Shit from You, Dude
Described by *HotWired* as "moulding an archetype for the online woman warrior", hard copy-turned-Netzine *Geek Girl* isn't just brain food for fierce cybergals. Second issue, "m@gic, m@nga and m@yhem", has funny, intelligent features with a strong technowhore theme. A highlight is the Kathy Acker interview where she rants about her motorbike, her recent excommunication from PG-rated America Online and the life-hijacking potential of her computer. Conspiracy theorist and alien victim Jim Keith features as do the Electronic Witches who wire up activist women in war-torn areas such as Bosnia.

Evolution, Devolution
A conceptual offering of philosophic technoshamanism known as The Deoxyribonucleic Hyperdimension, this site is the last word in evolutionary ideas and knowledge. In cyberneuro reflections of visible language and virtual reality, the glittering Web-strands of Hyperdimension resonate with the octaves of energy approaching satori.

Terence McKenna Land, Gaian Cybermind and, our favourite, "It's Time to Mutate", are among the many interconnections of this global rave telepathy. Have a hyperdimensional mind-meld and engage in the revolution of the human being.

Mother Earth
Unless you were an astronaut, you could never appreciate the beauty of the earth from space. You couldn't fly around, seeing it from this angle or that.

Well, you still can't. But you *can* generate your own animation of the earth rotating, at whatever angle, with the sun in any position, over the Web. The Xearth viewer even lets you add grid lines to your globe – something you could never do from space.

Win Friends and Be Popular. Sorta.
Do you go to cocktail parties and have nothing to say? Do you hover over the devilled eggs because you're clueless about the Internet (that hipper-than-hip topic)? Well, you can win friends and be the star of the party with Tabor Griffin Communications's e-zine, *WEBster*. Get clued on the latest cyber wheeling and dealing – which online service is being bought out and by whom. Forget the days when you thought a SLIP was invented by Freud. Now you can talk intelligently about the latest Web software and hardware – once you've downloaded the articles to your own neural net.

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nsweeney@jesus.ox.ac.uk
Nick Banicic *nvb10@cus.cam.ac.uk*
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Michelle Stavrinou
ah25@cityscape.co.uk
James Bloom
james@pinkrobo.demon.co.uk
Azeem Azhar
Web: *http://www.paranoia.com/~az/*
Marcos Sanchez *marcos@nrh.com*

Dawkins

◄ 57 Dawkins is saying about evolution is as bold for our time as Darwin's tenets were for his. Dawkins has redefined the fundamental doctrines of "natural selection" in ways that transform the vocabulary of evolutionary biology into the new realms of digital media.

What distinguishes Dawkins from most of his evolutionary peers is his passionate embrace of digital technologies as an appropriate medium for testing Darwin. Dawkins doesn't have to go to the Galápagos Islands to test hypotheses about genetic diversity; he can go to the keyboard.

Unlike the life scientists who treat the personal computer as a calculator, Dawkins intuitively sensed that the computer should be viewed as a medium for evolution. If genes are really all about the transmission of information, what better medium than the computer to simulate how information might evolve?

Born and raised in East Africa, Dawkins grew up amid one of the most irresistible bioscapes on Earth. Dawkins came to Oxford in 1959 as an undergraduate, and eventually came under the spell of Niko Tinbergen, the eminent Danish biologist. Author of *The Study of Instinct* and winner of the Nobel Prize in biology for his pioneering work on animal behaviour, Tinbergen was one of the first of the modern ethologists (biologists who explore and explain the nature of animal behaviour). What is instinct? Tinbergen would ask. What behaviour is learned? How can we truly know the difference? How does behaviour change? How do animals communicate? How do animals behave differently in groups than as individuals? Why do animals co-operate? How do they compete?

Ethology, as Tinbergen constantly stressed, was a highly interdisciplinary biological science, requiring insights into psychology, physiology, ecology, sociology, taxonomy and evolution. Tinbergen focused on the eternal tension between the breadth of behaviours observed in nature and a scientist's need to reduce these behaviours to a set of fundamental principles. "My own dominant recollection of his undergraduate lectures," Dawkins recalls, "was that I was particularly taken with two phrases of his – *behaviour machinery* and *equipment for survival*. When I came to write my first book, I combined them into the brief phrase *survival machine*."

Dawkins developed a special protégé/mentor relationship with Tinbergen. After a stint at the University of California at Berkeley, Dawkins returned to his alma mater, where he ultimately became a fellow at New College (he still teaches there).

Dawkins's dual interest in the nature of machines and the machinery of nature took place amid the rise of molecular biology. Just a few years after Francis Crick and James Watson's 1953 discovery of the double helix, the molecular biologists – not the naturalists, zoologists or ethologists – began calling the intellectual shots in biology.

The increased ability to track and explain what the genome was and what it was doing – classic reductionalist science as opposed to mere descriptive taxonomies – radicalised the way nature was observed. Centuries of animal breeding had, of course, created an explicit awareness of links between genetic endowment and behaviour. The double helix became the new scaffold for erecting theories of evolution.

For the young Dawkins, the ethology of Tinbergen quickly became the conceptual lens through which he viewed the world. Behaviour, say of the chicks he studied as a graduate student, was the empirical observation that Dawkins sought to identify and explain. At the same time that he was observing chicken processing, Dawkins was busy processing his data with a clunky punch-tape Eliot 803. The machinery metaphor – the machinery meme – that resonated with and reinforced Tinbergen's ideas, ultimately welded itself to Dawkins's strong notions of the primacy of the gene. What happens to scientific thinking if the survival machine is defined by the machinery of the genes?

Amid this primordial soup of new paradigms, Richard Dawkins the ethologist rapidly mutated into an evolutionary biologist. In 1965, he hit upon an idea breath-takingly simple to understand but extra-ordinarily powerful in its implications. In essence, Dawkins argued for an ethology of the gene: How do genes communicate? How do genes behave differently in groups than they do as individuals? Why do genes co-operate? How do genes compete? The same questions ethologists ask about chicks and geese and chimpanzees are virtually identical to the sorts of questions they should be asking about the genome and its genes. Others had played with this notion before, but Dawkins made it his own and aggressively pushed it into the mainstream of science culture.

As the first true ethologist of the gene, Dawkins de facto became an evolutionary biologist. How genes behave over time – which ones dominate, which ones die off, which ones co-operate, which ones compete, which ones change, which ones remain the same – is the very definition of an evolution based on the flow of information.

When Dawkins published *The Selfish Gene* in 1976, the book further heated the debate over whether humans were ruled more by nature or nurture, a debate refuelled by the emerging sociobiologists – notably Harvard biologist Edward O Wilson in his 1975 book *Sociobiology*.

By proposing an ethology of the gene, Dawkins shifted that debate away from the individual animal as the unit of evolution to the nature, nurture and behaviour of the genes. With *The Selfish Gene*, Dawkins offered scientists a conceptual bridge between the reductionist imperatives of molecular biology and the taxonomies of zoology, psychology and sociology. In other words, the metaphor of the selfish gene not only created an important context to explain human and animal behaviour – it also created a framework for molecular biologists to examine the organic interactions of genes. The metaphor scaled from double helices to human interactions.

Our genetic system, which is the universal system of all life on the planet, is digital to the core.

But looking at the richness and complexity of life on Earth, Dawkins freely acknowledged that an ethology of the gene alone was simply not robust enough to explain evolution. So he applied a Darwinian view of culture, as well. Dawkins argued for the concept of *memes* – ideas that are, to use the felicitous phrase of William Burroughs, "viruses of the mind".

Memes are to cultural inheritance what genes are to biological heredity. A meme for, say, astrology, could parasitise a mind just as surely as a hookworm could infest

someone's bowels. Ideas – like genes – could compete and co-operate, mutate and conserve. They, too, are operated on by natural selection. Human evolution, Dawkins postulates, is a function of a co-evolution between genes and memes.

Even that was not enough. Dawkins's intellectual adventure went well beyond the ethology of genes and memes to explore an even more radical insight into the nature of evolutionary dynamics. This idea, too, was astonishingly simple, but it offers a powerful intellectual framework for a new understanding of life as an information process.

What do genes and memes have in common? Dawkins asked. They are replicators. Through various but distinct coded systems, they reproduce; they effect change in their world so they can propagate, just like viruses in either digital or organic form. Dawkins's most powerful paradigm is that the unit of evolution is not the individual – the gene – or the meme, but the *replicator*.

This was apostasy to Darwinian evolutionists, who took it as dogma that the dynamics of natural selection cared only for the fitness of individual organisms and absolutely nothing else. But here was Dawkins saying that what really counted in "nature tooth and claw" was the replicating code beneath the organism. Evolution is really the story of replicators *über alles*.

Dawkins aggressively evolved this replicator concept. He noted that discussing the evolution of birds without looking hard at the evolution of their nests, or at beavers without considering the evolution of their dams would be prima facie ridiculous. Each is essential to the survival of the other.

It is the combination of bird and nest, the combination of beaver and dam, that gives a competitive edge to the animals who build them. Not only does the body of an organism march to the orders of its genes, but so do the artifacts the organism builds or uses. In this sense, the egg uses both a chicken and a nest to make another egg – and so the nest, too, is an evolutionary extension of the egg.

In biology, the genes in the egg would be called its genotype, while the physical expression of those genes – the chicken – would be called its phenotype.

Dawkins called this marriage of organism to artifact *The Extended Phenotype* – the title of his second book, published in 1982. Still extending the outer limits of his replicator idea, Dawkins used this "extended phenotype" construct to look beyond the individual and artifact to embrace the family of the organism, its social group, the tools and environments it created. These are part of the physical "readout" of the genes, the extended phenotype of the replicating code. The invisible code in genes are therefore, in a very real sense, manipulating large chunks of the visible world to their selfish advantage.

Of course humans – with our massive and complex array of technologies – have extended our phenotypes much more than any other living species. Just like a bird's nest, a beaver's dam or a groundhog's intricate set of underground tunnels, our technologies are now an integral part of our evolutionary fitness.

In light of Dawkins's work, to be a scientist today and talk about human evolution divorced from technological evolution no longer makes sense. In the truest and most fundamental sense, human evolution is now inextricably bound with technological evolution. Taken to its natural conclusion, Dawkins's idea suggests that humankind is really co-evolving with its artifacts; genes that can't cope with that new reality will not survive into future millennia.

What happens to life – to artificial life – when our unit of evolutionary observation becomes the replicator? By framing life and its evolution in the context of replicators and networks of replicators, Dawkins has forced all of biology to re-examine its assumptions of the fundamental mechanics of living things.

Is technology just what our genes want, or is it a cultural conspiracy of our genes and memes? Does human DNA control the technosphere we've created and live in and around? What does it mean to say that nerve gas and microprocessors are extensions of selfish genes? These questions – as much as the genetic underpinning of embryology and neuro-physiology – are the the sorts of questions that evolutionists must now address, posits Dawkins.

So essential is Dawkins's work to redefining life that he might have fairly titled one of his books *On the Origin of Replicators* and expected it to revolutionise science in the most radical fashion since Darwin. But Dawkins is not the sort to run the risk of parodying Darwin in this way, because of his respect for the principles of natural selection. Already, however, this transforming view is proving to be an extraordinarily robust meme that is rapidly replicating in human minds.

When Dawkins spoke at the first artificial-life conference in Los Alamos, New Mexico, in 1987, he delivered a paper on "The Evolution of Evolvability". This essay argues that *evolvability* is a trait that can be (and has been) selected for in evolution. The ability to be genetically responsive to the environment through such a mechanism as, say, sex, has an enormous impact on one's evolutionary fitness. Dawkins's paper has become essential reading in the artificial-life community. His multidisciplinary, interdisciplinary fluency in fields ranging from ethology to software has made him someone who is closely watched not only by fans of his popular books but especially by his scientific peers, who range from Stephen Jay Gould to Marvin Minsky to Roger Penrose.

Now 54, Dawkins has few students of his own. He quietly confesses that he wouldn't mind becoming Oxford's first professor of synthetic evolution. (He is seriously on the lookout for an intellectually adventuresome benefactor to endow such a chair for him.) Dawkins likes tossing around a semi-serious idea of awarding prize money to spur innovation and ingenuity in artificial life. (A decade ago, when his Biomorph program came out, he offered $1,000 of his own money to anyone who could find the exact image of a chalice, or Holy Grail, he had come across in his own explorations. To Dawkins's surprise, a Caltech software jock claimed the prize within a year.)

Genes are pure information that can be encoded, recoded and decoded without any degradation or change of meaning.

Dawkins detailed his new idea in an exchange of e-mail: "My prize would be for a visually appealing world in which the life-forms have a visible, and preferably 3-D, morphology on the computer screen. They must evolve adaptations not just to 'inanimate' factors like the weather (which would produce essentially predictable, not emergent evolution) but to other evolving life forms (which is a recipe for emergent properties)."

Ingenious, yet there seems to be something vital missing from Dawkins's venture 106 ►

Dawkins

◄ 105 into multimedia evolution: the hard maths. In his recent autobiography, Edward O Wilson, every bit as much the ethologist as Dawkins, describes a lifetime odyssey of intellectual collaboration. Wilson recognised that he was woefully deficient in mathematical skills, so he proceeded to forge close ties with a number of biostatisticians and mathematicians to help him build accurate models of population biology.

By contrast, Dawkins evinces some remorse but no particular desire to go beyond his amateur programming and formidable rhetorical skills to formalise his revolutionary evolutionary ideas into elegant algorithms that might win the respect of great mathematicians in the science community. He has had collaborators, none of whom ever really brought the rigour of quantitative formalism to his work. Dawkins's métier is metaphor – not mathematics.

Indeed, in an e-mail exchange, Dawkins is positively testy about discussing what might be the new maths of replicators. He writes: "Equations are not my language. They are yours, and it was you that repeatedly brought the conversation back to equations. I'm not saying that this is not an important way to look at life. Just that it isn't my way, and I'm not equipped to answer questions on it."

That's not to say Dawkins needs to become expert in cellular automata or the new maths of non-linear dynamics to continue being a thought leader in the rapidly evolving field of artificial life. But, just as fields like physics and chemistry have increasingly become reified into mathematical representations, it seems inevitable that artificial life will mutate along similar dimensions.

Perhaps because of this, the lovely colour biomorphs and colour mollusks that he has bred on his Macintosh look, umm, a little anachronistic compared with the new artificial-life menageries and terraria created by artificial-life breeders like Karl Sims and Tom Ray, who have a superb sense of computationally intensive algorithms. While Sims, working on a Connection Machine, can breed a digital 3-D creature that shimmers with lifelike dynamism, Dawkins's own virtual mollusk looks much like the sort of mollusk you find in a museum.

Dawkins will not be the intellectual adventurer who creates a set of artificial-life algorithms comparable to, say, Newton's calculus. But it would be a fitting tribute if, once they are created, those algorithms carried the name of the man whose memes made their discovery possible. ■ ■ ■

◄ 57 What is more, they are truly digital, in the full and strong sense of computers and compact disks. The genetic code is not a binary code as in computers, nor an eight-level code as in some telephone systems, but a quaternary code, with four symbols. The machine code of the genes is uncannily computer-like. Apart from differences in jargon, the pages of a molecular-biology journal might be interchanged with those of a computer-engineering journal.

Among many other consequences, this digital revolution at the very core of life has dealt the final, killing blow to vitalism – the belief that living material is deeply distinct from non-living material.

Up until 1953, it was still possible to believe that there was something fundamentally and irreducibly mysterious in living protoplasm. No longer. Even those philosophers who had been predisposed to a mechanistic view of life would not have dared hope for such total fulfilment of their wildest dreams.

The following science fiction plot is feasible, given a technology that differs from today's only in being a little speeded up. Professor Jim Crickson has been kidnapped by an evil foreign power and forced to work in its biological-warfare labs. To save civilisation, it is vitally important that he should communicate some top-secret information to the outside world, but all normal channels of communication are denied him. Except one.

The DNA code consists of 64 triplet "codons", enough for a complete upper and lower-case English alphabet plus 10 numerals, a space character and a full stop. Professor Crickson takes a virulent influenza virus off the laboratory shelf and engineers into its genome the complete text of his message to the outside world, in perfectly formed English sentences. He repeats his message over and over again in the engineered genome, adding an easily recognisable "flag" sequence – say, the first 10 prime numbers. He then infects himself with the virus and sneezes in a room full of people. A wave of flu sweeps the world and medical labs in distant lands set to work to sequence its genome in an attempt to design a vaccine.

It soon becomes apparent that there is a strange repeated pattern in the genome. Alerted by the prime numbers – which cannot have arisen spontaneously – somebody tumbles on the idea of deploying code-breaking techniques. From there it would be short work to read the full English text of Professor Crickson's message, sneezed around the world.

Our genetic system, which is the universal system of all life on the planet, is digital to the core. With word-for-word accuracy, you could encode the whole of the New Testament in those parts of the human genome which are at present filled with "junk" DNA – that is, DNA not used, at least in the ordinary way, by the body.

Every cell in your body encodes the equivalent of 715 Mbytes of information, reeling off digital characters via numerous reading heads working simultaneously. In every cell, these tapes – the chromosomes – contain the same information, but the reading heads in different kinds of cells seek out different parts of the database for their own specialist purposes. That is why muscle cells are different from liver cells. There is no spirit-driven life force, no throbbing, heaving, pullulating, protoplasmic, mystic jelly. Life is just bytes and bytes and bytes of digital information.

Genes are pure information – information that can be encoded, recoded and decoded, without any degradation or change of meaning. Pure information can be copied and, since it is digital information, the fidelity of the copying can be immense.

DNA characters are copied with an accuracy that rivals anything modern engineers can do. They are copied down the generations, with just enough occasional errors to introduce variety. Among this variety, those coded combinations that become more numerous in the world will obviously and automatically be the ones that, when decoded and obeyed inside bodies, make those bodies take active steps to preserve and propagate those same DNA messages.

We – and that means all living things – are survival machines programmed to propagate the digital database that did the programming.

With hindsight, it could not have been otherwise. An analog genetic system could be imagined. But it would resemble a Xerox of a Xerox of a Xerox. After 800 photocopying "generations", all that's left is a grey blur. Boosted telephone systems, recopied cassette tapes, photocopies of photocopies – analog signals are so vulnerable to cumulative degradation that copying cannot be sustained beyond a limited number of generations.

Genes, on the other hand, can self-copy for 10 million generations and scarcely degrade at all. Darwinism works only because – apart from discrete mutations, which natural selection either weeds out or preserves – the copying process is perfect.

Only a digital genetic system is able to sustain Darwinism over aeons of geological time. Only a digital river of genetic code could have carried us out of life's Precambrian Eden and into the present day. ■ ■ ■

Technopagans

◄66 in the midst of mundane space time. Using a combination of ceremonial performance, ritual objects and imagination, Pagans carve out these tightly bounded zones in both physical and psychic space. Pagan rituals vary quite a bit, but the stage is often set by invoking the four elements that the ancients believed composed all matter. Often symbolised by coloured candles or statues, these four "Watchtowers" stand like imaginary sentinels in the four cardinal directions of the circle.

But tonight's Watchtowers are four 486 PCs networked through an Ethernet and linked to a SPARC station with an Internet connection. Pesce is attempting to link old and new, and his setup points out the degree to which our society has replaced air, earth, fire and water with silicon, plastic, wire and glass. The four monitors face into the circle, glowing patiently in the subdued light. Each machine is running WorldView and each screen shows a different angle on a virtual space that a crony of Pesce's concocted with 3D Studio. The ritual circle mirrors the one that Pesce will create in the room: an ornate altar stands on a silver pentagram splayed like a magic carpet over the digital abyss; four multicoloured polyhedrons representing the elements hover around the circle; a fifth element, a spiked and metallic "chaos sphere", floats about like some ominous foe from *Doom*.

WorldView is an x-y-z-based co-ordinate system, and Pesce has planted this cosy virtual world at its very heart: co-ordinates 0,0,0. As Pesce explains to the crowd, the circle is navigable independently on each PC and simultaneously available on the World Wide Web to anyone using WorldView. More standard Web browsers linked to the Cyber-Samhain site would also turn up the usual pages of text and images – in this case, invocations and various digital fetishes downloaded and hyperlinked by a handful of online Pagans scattered around the world.

Wearing a top hat, a bearded network administrator named James leads the crowd through mantras and grounding exercises. A storyteller tells a tale. Then, in walks the evening's priestess, a Russian-born artist and exotic dancer named Marina Berlin. She's buck-naked, her body painted with snakes and suns and flying eyes. "Back to the '60s," whispers a silver-haired man to my left. Stepping lightly, Berlin traces a circle along the ground as she clangs two piercing Tibetan bells together 13 times.

With a loud, sonorous voice, Pesce races around the circle, formally casting and calling those resonant archetypes known as the gods. "Welcome Maiden, Mother, Crone," he bellows in the sing-song rhymes common to Pagan chants. "To the North that is Your throne, / For we have set Your altar there, / Come to circle; now be here!"

How much Pagans believe in the lusty wine-swilling gods of yore is a complex question. Most Pagans embrace these entities with a combination of conviction and levity, superstition, psychology and hard-core materialism. Some think the gods are as real as rocks, some remain sceptical atheists, some think the beings have no more or less reality than Captain Kirk. Tonight's technopagans aren't taking anything too seriously and after the spirits are assembled, Pesce announces the "sacred bullshit hour" and hands the wand to his friend and mentor Rowley.

"Witchcraft evolved into the art of advertising," Rowley begins. "In ancient times, they didn't have TV – the venue was the ritual occurrence. Eight times a year, people would go to the top of the hill, to the festival spot and there would be a party. They'd drink, dance in rings and sing rhyming couplets." Today's Pagans attempt to recover that deep seasonal rhythm in the midst of a society that yokes all phenomena to the manipulative control of man. "It's about harmonising with the tides of time, the emergent patterns of nature. It's about learning how to surf."

Samhain's lesson is the inevitability of death in a world of flux, and so Rowley leads the assembled crowd through the Scapegoat Dance, a Celtic version of "London Bridge is falling down". A roomful of geeks, techno-yuppies and multimedia converts circle around in the monitor glow, chanting and laughing and passing beneath a cloth that Rowley and Pesce dangle over their heads like the Reaper's scythe.

As a long-time participant-observer in the Pagan community, I join in with pleasure. Trudging along, grasping some stranger's sweaty shoulder, I'm reminded of those gung-ho futurists who claim that technology will free us from the body, from nature, even from death. I realise how unbalanced such desires are. From our first to final breath, we are woven into a world without which we are nothing, and our glittering electronic nets are not separate from that ancient network.

In 1985, when National Public Radio reporter (and witch) Margot Adler was revising *Drawing Down the Moon*, her great social history of American Paganism, she surveyed the Pagan community and discovered that an "amazingly" high percentage of folks drew their paypacket from technical fields and from the computer industry. Respondents gave many reasons for this curious affinity – everything from "computers are elementals in disguise" to the simple fact that the computer industry provided jobs for the kind of smart, iconoclastic and experimental folk that Paganism attracts. Pagans like to do things – make mead, publish zines, wield swords during gatherings of the Society for Creative Anachronism. And many like to hack code. But if you dig deep enough, you find more intimate correspondences between computer culture and Paganism. One link is science fiction and fantasy fandom, a world whose role-playing, nerd humour and mythic enthusiasm has bred many a Pagan.

The Church of All Worlds, one of the more eclectic and long-lasting Pagan groups (and the first to use the word *pagan*), began in 1961 when some undergrad libertarians got jazzed by the Martian religion described in Robert Heinlein's *Stranger in a Strange Land*. Today, you can find occult books at science fiction conferences and Klingon rituals at Pagan gatherings.

Science fiction and fantasy also make up the archetypal hacker canon. Since at least the '60s, countless code freaks and techies have enthusiastically participated in science fiction and fantasy fandom – it's even leaked into their jokes and jargon (the "wizards" and "demons" of Unix are only one example).

Most Pagans embrace the gods of yore with a combination of conviction and levity, superstition and hard-core materialism.

When these early hackers started building virtual worlds, it's no accident they copped these realms from their favourite genres. Like software programs, the worlds of science fiction and fantasy "run" on stock elements and internally consistent rules. One of the first digital playgrounds was MIT's early *Space Wars*, a rocket-ship shoot-'em-up. But the Stanford AI lab's *Adventure* game lagged not far behind. A text-based analogue of *Dungeons & Dragons* that anticipated today's MUDs, *Adventure* shows how comfortably a magical metaphor of caverns, swords 108►

Technopagans

◄ 107 and spells fits the program's nested levels of coded puzzles.

Magic and Pagan gods fill the literature of cyberspace as well. *Count Zero*, the second of William Gibson's canonical trilogy, follows the fragmentation of *Neuromancer*'s sentient artificial intelligence into the polytheistic pantheon of the Afro-Haitian *loa* – gods that Gibson said entered his own text with a certain serendipitous panache. "I was writing the second book and wasn't getting off on it," he told me a few years ago. "I just picked up a *National Geographic* and read something about voodoo and thought, what the hell, I'll just throw these things in and see what happens. Afterwards, when I read up on voodoo more, I felt I'd been really lucky. The African religious impulse lends itself to a computer world much more than anything in the West. You cut deals with your favourite deity – it's like those religions already are dealing with artificial intelligences." One book Gibson read reproduced many Haitian *veves*, complex magical glyphs drawn with white flour on the ritual floor. "Those things look just like printed circuits," he mused.

Gibson's synchronicity makes a lot of sense to one online Pagan I know, a long-time LambdaMOOer who named herself "legba" after one of these *loa*. The West African trickster Legba was carried across the Atlantic by Yoruban slaves and, along with the rest of his spiritual kin, was fused with Catholic saints and other African spirits to create the pantheons of New World religions such as Cuba's Santería, Brazil's Candomblé and Haiti's Vodun (Voodoo).

Like the Greek god Hermes, Legba rules messages and gateways and tricks, and as the lord of the crossroads, he is invoked at the onset of countless rituals that continue to be performed from São Paulo to Montreal. As legba (who doesn't capitalise her handle out of respect for the *loa*) told me, "I chose that name because it seemed appropriate for what MOOing allows – a way to be between the worlds, with language the means of interaction. Words shape everything there and are, at the same time, little bits of light, pure ideas, packets in no-space transferring everywhere with incredible speed. If you regard magic in the literal sense of influencing the universe according to the will of the magician, then simply *being* on the MOO is magic. The Net is pure Legba space."

Whether drawn from science fiction, spirituality or TV, metaphors make cyberspace. Though Vernor Vinge's *True Names* has received far less attention than *Neuromancer*, the novella explores the implications of cyberspace metaphors in one of the great visions of online VR. Rather than Gibson's dazzling Cartesian videogame, Vinge imagined cyberspace as a low-bandwidth world of sprites, castles and swamps that, like today's MUDs, required the imaginative participation of the users. Anticipating crypto-anarchist obsessions, the novella's heroic covens elude state control through encryption spells that cloak their doings and their "true names".

Some of Vinge's sorcerers argue that the magical imagery of covens and spells is just a more convenient way to manipulate encrypted data space than the rational and atomistic language of clients, files and communications protocols. Regardless of magic's efficacy, Vinge realised that its metaphors work curiously well. And as legendary science fiction author Arthur C Clarke said in his 1962 *Profiles of the Future*, "new technology is indistinguishable from magic."

But convenience and superstition alone do not explain the powerful resonance between hermetic magic and communications technology. Even if magic is only a metaphor, then we must remember how metaphoric computers have become. Interfaces and online avatars are working metaphors, while visualisation techniques use hypothetical models and colourful imagery to squeeze information from raw data. What is simulation but a metaphor so sharp we forget it's not a metaphor?

Rather than work with traditional occult systems, chaos magicians construct their own rules or throw them out altogether.

Then there are the images we project onto our computers. Already, many users treat their desktops as pesky, if powerful, sprites. As online agents, smart networks and intelligent gizmos permeate the space of our everyday lives, these anthropomorphic habits will leave the Turing test in the dust. As computers blanket the world like digital kudzo, we surround ourselves with an animated webwork of complex, powerful and unseen forces that even the "experts" can't totally comprehend. Our technological environment may soon appear as sentient as the caves, lakes and forests in which the first magicians glimpsed the gods.

The alchemists, healers and astrological astronomers of old did their science in the context of sacred imagination, a context that was stripped away by the Enlightenment's emphasis on detached rationalism. Today, in the silicon crucible of computer culture, digital denizens are once again building bridges between logic and fantasy, maths and myth, the inner and the outer worlds.

Technopagans, for all their New Age kitsch and bohemian brouhaha, are taking the spiritual potential of this postmodern fusion seriously. As VR designer Brenda Laurel put it in an e-mail interview, "Pagan spirituality on the Net combines the decentralising force that characterises the current stage in human development, the revitalising power of spiritual practice and the evolutionary potential of technology. Revitalising our use of technology through spiritual practice is an excellent way to create more of those evolutionary contexts and to unleash the alchemical power of it all."

These days, the Internet has replaced zines as the clearinghouse of contemporary heresy, and magicians are just one more thread in the Net's rainbow fringe of anarchists, Extropians, conspiracy theorists, *X-Files* fans and right-wing kooks. Combing through esoteric mailing lists and Usenet groups like *alt.magick.chaos* and *soc.religion.eastern*, I kept encountering someone called Tyagi Nagasiva and his voluminous, sharp and contentious posts on everything from Sufism to Satanism. Tyagi posted so much to *alt.magick.chaos* that Simon, one of the group's founders, created *alt.magick.tyagi* to divert the flow. He has edited an FAQ, compiled the *Mage's Guide to the Internet* and helped construct Divination Web, an occult MUD. Given his e-mail address – *tyagi@houseofkaos.abyss.com* – it almost seemed as if the guy lived online, like some oracular Unix demon or digital genie.

After I initiated an online exchange, Tyagi agreed to an interview. "You could come here to the House of Kaos, or we could meet somewhere else if you're more comfortable with that," he e-mailed me. Visions of haunted shacks and dank, mouldering basements danced in my head. I pictured him as a hefty and grizzled hermit with a scruffy beard and menacing eyes. But the 33-year-old man who greeted me in the doorway of a modest San José home was friendly, thin and clean-

shaven. Homemade monk's robes cloaked his tall frame, and the gaze from his black eyes was intense and unwavering. He gave me a welcoming hug and ushered me inside.

It was like walking into a surrealist temple. Brightly coloured paper covered the walls, which were pinned with raptor feathers and collages of Hindu posters and fantasy illustrations. Cards from the Secret Dakini Oracle were strung along the edge of the ceiling, along with hexagrams from the *I Ching*. To the north sits his altar. Along with the usual candles, herbs and incense holders, Tyagi has added a bamboo flute, a water pipe stuffed with plants and one of Jack Chick's Christian comic-book tracts. The altar is dedicated to Kali, the dark and devouring Hindu goddess of destruction whose statue Tyagi occasionally anoints with his lover's menstrual blood. Other figures include a Sorcerer's Apprentice Mickey Mouse and a rainbow-haired troll. On the windowsill lies the tail of Vlad the Impaler, a deceased cat. Near the altar sits a beaten-up Apple II with a trackball that resembles a swirling blue crystal ball.

On one wall, Tyagi has posted the words Charity, Poverty and Silence. They are reminders of monastic vows Tyagi took, vows with traditional names but his own, carefully worked out meanings. (Tyagi is an adopted name that means "one who renounces".) "I just stopped grabbing after things," he said. "I made certain limitations and assertions on how I wanted to live and be in the world." His job as a security guard gives him just enough cash for rent, food and dial-up time.

"For a long time, I had the desire to find the truth at all costs or die trying," Tyagi said in a measured and quiet voice. After reading and deeply researching philosophy, mysticism and the occult, Tyagi began cobbling together his own mythic structures, divination systems and rituals – an eclectic spirituality well suited to the Net's culture of complex interconnection. Like many technopagans, Tyagi paid his dues behind the eight-sided die, exploring role-playing games like Dungeons & Dragons and Call of Cthulhu. He also delved heavily into chaos magic, a rather novel development on the occult fringe that's well represented on the Net. Rather than work with traditional occult systems, chaos magicians either construct their own rules or throw them out altogether, spontaneously enacting rituals that break through fixed mental categories and evoke unknown – and often terrifying – entities and experiences.

"Using popular media is an important aspect of chaos magic," Tyagi says as he scratches the furry neck of Eris, the Doggess of Discord. "Instead of rejecting media like many Pagans, we use them as magical tools." He points out that Thee Temple ov Psychick Youth, the chaotic magical organisation that surrounds the industrial band Psychick TV, would practice divination with televisions tuned to display snow. "Most Pagans would get online and say, 'let's get together somewhere and do a ritual'. Chaos magicians would say, 'let's do the ritual online'."

After compiling his original *Mage's Guide to the Internet* – an exhaustive directory of mailing lists, ftp sites, newsgroups and MOOs – Tyagi hooked up with Moonchilde, also known as Joseph Traub, a god of an online MUSH devoted to Anne McCaffrey's *Dragonriders of Pern* series, and created an occult MUD called Divination Web (telnet *bill.math.uconn.edu9393*). Originally, DivWeb presented a virtual geography of spiritual systems: a great Kabbalistic Tree of Life stood in the centre of a wheel whose various spokes mapped out different astrological signs and psychological states and linked up to other realms – Celtic, shamanic, Satanic. Down one path lay an amusement park devoted to religious heresy; another direction would send you down the river of the Egyptian afterlife. But Tyagi found the layout too structured and now you just log into the Void.

These days, Tyagi cruises the Net for four to six hours a day during the week. "Being online is part of my practice. It's kind of a hermit-like existence, like going into a cave. I'm not really connected to people. I'm just sending out messages and receiving them back."

Tyagi finds that after logging heavy online time, he interacts with the offline world as if it were an object-oriented database.

But for MOO-oriented magicians like Tyagi, the Net is more than a place of disembodied information. "Cyberspace is a different dimension of interaction. There's a window between the person who's typing and the person who finds himself in cyberspace," Tyagi explains. "If you're familiar enough with the tool, you can project yourself into that realm. For me, I start to associate myself with the words that I'm typing. It's less like I'm putting letters onto a screen and more like there's a description of an experience and I'm having it."

Like some MUD users, Tyagi finds that after logging heavy time in these online realms, he interacts with the offline world as if it were an object-oriented database. "Within the physical world, there are certain subsets that are MUDs – like a book. A book is a kind of MUD – you can get into it and move around. It's a place to wander. So MUDs become a powerful metaphor to see in a personal sense how we interact with different messages. Real life is the fusion of the various MUDs. It's where all of them intersect."

For the Druids and hermetic scholars of old, the world was alive with intelligent messages: every star and stone was a signature; every beast and tree spoke its being. The cosmos was a living book where humans wandered as both readers and writers. The wise ones just read deeper, uncovering both mystical correspondences and the hands-on knowledge of experimental science.

To the thousands of network denizens who live inside MUDs and MOOs like DivWeb or LambdaMOO, this worldview is not as musty and quaint as it might seem to the rest of us. As text-based virtual worlds, MUDs are entirely constructed with language: the surface descriptions of objects, rooms and bodies; the active script of speech and gesture; and the powerful hidden spells of programming code. Many MOOs are even devoted to specific fictional worlds, turning the works of Anne McCaffrey or J R R Tolkien into living books.

For many VR designers and Net visionaries, MOOs are already fossils – primitive, low-bandwidth inklings of the great, simulated, sensory overloads of the future. But hardcore MOOers know how substantial and enchanting their textual worlds can become, especially when they're fired up with imagination, eroticism and performative speech.

All those elements are important in the conjurer's art, but to explore just how much MOOs had to do with magic, I sought out my old friend legba, a longtime Pagan with a serious MOO habit. Her usual haunt, LambdaMOO, has such heavy lag time, legba suggests we meet in Dhalgren MOO whose eerie imagery is lifted from Samuel Delaney's post-apocalyptic science fiction masterpiece.

That's how I wind up here on Dhalgren's riverbank. Across the water, the wounded city of Bellona flickers as flames consume its rotten dock front. I step onto a steel suspension bridge, edging past smashed toll booths and a few abandoned cars, then pass 110►

Technopagans

◄ 109 through cracked city streets on my way to legba's Crossroads. An old traffic light swings precariously. Along the desolate row of abandoned storefronts, I see the old Grocery Store, legba's abode. Through the large and grimy plate-glass window I can see an old sign that reads: Eggs, $15.95/dozen. The forebidding metal security grate is locked.

Legba pages me from wherever she currently is: "The next fun thing is figuring out how to get into the grocery store."

Knowing legba's sense of humour, I smash the window and scramble through the frame into the derelict shop. Dozens of flickering candles scatter shadows on the yellowing walls. I smell cheese and apples, and a sweet smoke that might be sage.

Legba hugs me. "Welcome!" I step back to take a look. Legba always wears borrowed bodies and I never know what form or gender they'll be. Now I see an assemblage: part human, part machine, part hallucination. Her mouth is lush, almost overripe against bone-white skin and her smile reveals a row of iridescent, serrated teeth. She's wearing a long black dress with one strap slipping off a bony, white shoulder. Folded across her narrow back is one long, black wing.

I'm still totally formless here, so legba urges me to describe my virtual flesh. I become an alien anthropologist, a tall, spindly Zeta Reticuli with enormous black eyes and a vaguely quizzical demeanour. I don a long purple robe and dangle a diamond vajra pendant around my scrawny neck. Gender neutral.

Legba offers me some canned peaches. Pulling out a laser drill, I cut through the can, sniff the contents and then suck the peaches down in a flash through a silver straw.

Once again, I'm struck at how powerfully MOOs fuse writing and performance. Stretching forth a long, bony finger, I gently touch legba's shoulder. She shivers.

"Do we bring our bodies into cyberspace?"

Legba does.

She doesn't differentiate much anymore.

"How is this possible?" I ask. "Imagination? Astral plane? The word made flesh?"

"It's more like flesh made word," legba says. "Here your nerves are uttered. There's a sense of skin on bone, of gaze and touch, of presence. It's like those ancient spaces, yes, but without the separations between earth and heaven, man and angel."

Like many of the truly creative Pagans I've met, legba is solitary, working without a coven or close ties to Paganism's boisterous community. Despite her online presence and her interest in Ifá, the West African system of divination, legba's a pretty traditional witch; she completed a Craft apprenticeship with Pagans in Ann Arbor and studied folklore and mythology in Ireland. "But I was sort of born this way," she says. "There was this voice that I always heard and followed. I got the name for it, for her, through reading the right thing at the right time. This was the mid to late '70s and it was in the air again. I went to Ireland looking for the goddess and became an atheist. Then she started looking out through my eyes. For me, it's about knowing, *seeing*, being inside the sentience of existence and walking in the connections."

These connections remind me of the Crossroads legba has built here and on LambdaMOO. She nods. "For me, simultaneously being in VR and in RL [real life] is the crossroads." Of course, the Crossroads is also the mythic abode of Legba, her namesake. "Legba's the gateway," she explains. "The way between worlds, the trickster, the phallus and the maze. He's words and their meanings, and limericks and puns, and elephant jokes and –"

She pauses. "Do you remember the AI in *Count Zero* who made those Cornell Boxes?" she asks. "The AI built incredible shadow boxes, assemblages of the scraps and bits and detritus of humanity, at random, but with a machine's intentionality." She catches her breath. "VR is that shadow box. And Legba is," she pauses, "that AI's intentionality."

But then she shrugs, shyly, refusing to make any questionable claims about online gods. "I'm just an atheist anarchist who does what they tell me to do," she says, referring to what she calls the "contemporary holograms" of the gods. "It works, that's all."

I asked her when she first realised that MOOs "worked". She told me about the time her friend Bakunin showed her how to crawl inside a dishwasher, sit through the wash-and-rinse cycle, and come out all clean. She realised that in these virtual object-oriented spaces, things actually change their properties. "It's like alchemy," she said.

"The other experience was the first time I really desired somebody, without scent or body or touch or any of the usual clues, and they didn't even know what gender I was. The usual markers become meaningless."

Like many MOOers, legba enjoys swapping genders and bodies and exploring net.sex. "Gender-fucking and morphing can be intensely magical. It's a very, very easy way of shape-changing. One of the characteristics of shamans in many cultures is that they're between genders, or doubly gendered. But more than that, morphing and net.sex can have an intensely unsettling effect on the psyche, one that enables the ecstatic state from which Pagan magic is done."

I reach out and gingerly poke one of her sharp teeth. "The electricity of nerves," I say. "The power of language."

She grins and closes her teeth on my finger, knife-point sharp, pressing just a little, but not enough to break the skin.

"It's more than the power of language," legba responds. "It's embodiment, squishy and dizzying, all in hard and yielding words and the slippery spaces between them. It's like fucking in language."

"But," I say, "jabbering in this textual realm is a far cry from what a lot of Pagans do – slamming a drum and dancing nude around a bonfire with horns on their heads."

She grins, well aware of the paradox. As she sees it, our culture already tries to rise above what Paganism finds most important (nature, earth, bodies, mother) and at first the disembodied freedom of cyberspace seems to lob us even further into artificial orbit.

"But the MOO isn't really like a parallel universe or an alternate space," legba says. "It's another aspect of the real world. The false dichotomy is to think that cyberspace and our RL bodies are really separate." I hear a call from the mother ship. "I must take my leave."

Her mouth is lush, almost overripe against bone-white skin, and her smile reveals a row of iridescent, serrated teeth.

Legba grins as well and hugs me goodbye. I try to smile, but it's difficult because grey aliens have such small mouths. So I bow, rub my vajra pendant and wave. For the moment, my encounter with technopaganism is done. I've glimpsed no visions on my PowerBook, no demons on the MOO and I can't quite believe the Web is the living mind of the Gaian Goddess. But even as I recall the phone lines, dial-up fees and clacking keyboards of my online experience, I can't erase the eerie sense that even now some ancient page of prophecy, penned in a crabbed and shaky hand, is being fulfilled in silicon. And then I hit @quit, and disappear into thin electronic air. ■ ■ ■

Architects

◄71 importance is as a theorist. The paradigm he's putting forward – of a generative, adaptive architecture, is very powerful and necessary at this point in architectural history. However, in order to present his case he's had to be somewhat reductive… Frazer's models seem to work by iterating simple shapes. They can't cope, yet, with high levels of complexity, such as you find in real-world buildings."

Still, the more visionary in Frazer's circle see their models eventually taking into account the social, economic and political context in which a structure will "take place". This seems, to say the least, a tad ambitious. "We're a long way off from that," Frazer admits. "But we're gradually increasing in sophistication. I see no reason why such things should not, in principle, be possible."

Others share his optimism. John Landsdown, Professor of Computer Aided Art and Design at the University of Middlesex, believes that Frazer's work is undoubtedly of importance. "As Buckminster Fuller said, new ideas take 30 years to affect architectural practice. Certainly John's ideas aren't in evidence in today's architecture, but I'm of the opinion that we will see them have great influence in the future… John's work has a certain flavour to it which captures the imagination."

Bottles and other monsters

Frazer is not alone in recognising the potential of evolutionary applications for design. Computer artist William Latham (see *Wired* 1.03) has been using genetic algorithms to create his trademark organic forms for some years. At IBM he worked in partnership with programmer Stephen Todd to develop the Mutator interface, a general-purpose GA tool which may soon become the first commercially available piece of evolutionary software. The Mutator can run evolutionary processes on any type of data, from 3-D form generation to stockmarket figures. Recently Latham and current programming partner Mark Atkinson have been using it to solve simple design problems. Their ambitions are less grandiose than those of Frazer's team – there is no attempt to output anything more complex than sketches to form the basis of designs. Yet the simplicity of the Mutator (it runs on a PC) and the speed with which it generates evolutionary sequences, indicate that GAs may soon be used not just in esoteric professional applications, but as part of standard software.

Latham demonstrates a sequence involving the design of a shampoo bottle. It's a simple point-and-click operation, so simple in fact that it is easy to overlook the radical new way the user is working with the computer. From an initial wide-bellied, slim-necked shape familiar to users of anti-dandruff shampoos, we are soon presented with a vast array of interesting options. Latham starts breeding the weird ones, and soon we're faced with something that probably ought to be housing a genie instead of helping combat those flaky scalp problems. But we get the picture. When he gives an impromptu workshop in how to breed profits by mutating corporate spreadsheets, we begin to understand why he is being courted by business, scientific and military interests worldwide.

But Frazer, at least, sees no reason to stop with simply evolving better business plans and architectural blueprints. Why, he asks, should evolution stop at the drawing board? If architects really can understand the key factors that make a building 'fit' its environment – and, through simulation, also understand the sorts of changes which make it a better or worse fit – then why can't architects build into their constructions the ability to keep changing and evolving even after they are built? Frazer has written excitedly of "a new form of designed artefact interacting and evolving in harmony with natural forces, including those of society". The holy grail (and here he shows the influence of heroes such as Buckminster Fuller and Nicholas Negroponte) is to produce buildings which will evolve in use, adapting themselves to their environments and to the needs of the people who live and work in them. If your building can go on perfecting itself after you have built it, then there is less pressure on the architect to anticipate every contingency, to foresee the unforeseeable. This is nothing less than the transference of intelligence from human to building, a vision of houses and office-blocks as artificial life.

Sensitive skin

This vision also owes more than a little to Cedric Price's never-constructed Generator project, on which both John and Julia Frazer worked as computer consultants. Price was asked to produce a building which would meet the changing needs of the Gilman Paper corporation. On a site in Florida, Price proposed to build a grid of foundation pads and a kit of parts to enable enclosures, screens and gangways to be arranged and rearranged with the help of a permanent on-site crane. Electronics were to be embedded in every component, so the building, like Frazer's electronic modelling kits, could transmit an image of its state at any given time. The design even incorporated a concept of "boredom". If the Gilman employees did not change it themselves, the structure would suggest possible reconfigurations, based on previously successful versions of itself.

The Generator, with its modular components and microprocessors, produced a host of new ideas – and, through the massive media coverage it spawned, gave the world the phrase "intelligent building". Since then, however, little progress has been made. When asked what architectural developments show promise in this area, Frazer points to the work of Malaysian architect Ken Yeang, a former student at the AA who has become known for building "bioclimatic skyscrapers", eco-buildings which "interact" in a primitive way with the environment around them.

Instead of air-conditioning, his buildings collect wind and channel it through wall and floor ducts. The buildings are often clad in semi-permeable skins which regulate heat loss. Atriums, openable windows and "sky-courts" encourage people to interact with the world outside. One spectacular tower, the Menara Boustead in Kuala Lumpur, is almost entirely covered by green plants, which give off oxygen and disperse CO_2 from the polluted street below.

A genuine evolutionary architecture will require a new generation of materials, which, like the plants with which Yeang covers his buildings, can themselves adapt to changing conditions. Structures built from inert matter are doomed to remain more or less static. Frazer's students are working on various projects which include light-sensitive skins and flexible membranes that will enable future buildings to react to their environment. But for now they have just a collection of prototypes and working models – and high hopes.

Assume for a minute that those high hopes are justified and that the practical difficulties can be overcome. The idea of evolutionary architecture still begs a basic question, however: if buildings evolve themselves, what is there left for architects to do? Welsh design radical John Chris Jones argues that the very idea of designing will change fundamentally. The idea of a final, perfected product, be it a toothbrush, a block of flats or a motorway interchange, will be abandoned in favour of a conception of dynamic process. The designer will be a facilitator rather than a controller. It's no wonder Jones is Frazer's favourite architectural theorist.

Evolutionary architecture is the digital embodiment of this dream of an unfettered, unegotistical creative process. Just as architecture defines people's environments, so too do people define architecture's. There seems no more logical way to achieve harmony than to set the two evolving together. ■ ■ ■

Interactive TV

◄ 79 Willards are probably among the most enthusiastic customers Time Warner will find, it seems reasonable to ask what their price is. Mr Willard says he wouldn't mind spending $75 to $80 per month on the system, a figure that Time Warner executives say could be typical. "We were paying that already in monthly spending on cable, plus movie rentals and videogames for the kids."

Will that be enough for Time Warner? Analysts estimate that the set-top terminals, custom built by Silicon Graphics and Scientific Atlanta, cost over $3,000 each. Then there's the sleek new remote-control units, the system's HP DeskJet 550C colour printers for printing coupons and the Atari Jaguar unit. Not to mention the elaborate network operations centre at Time Warner's offices. Add this up and the cost easily tops $5,000 per home for the 4,000 households that will have all this stuff when the test is in full swing, according to analysts and published reports.

Recouping investment on such networks won't be easy. This is why Tom Feige, the president of the Full Service Network, says, "there has to be more revenue than just the Willards's $80." Feige began his career selling cable subscriptions door-to-door in 1978. He's the man with a plan to supply 85 per cent of Time Warner's 9 million subscribers with the network by 1998 and the one who must figure out how this system will eventually make money for the company. He won't comment on reports of how much all this is costing Time Warner. But he says, "we think the expense is worthwhile because it lets us climb a steep learning curve. We'll be finding out what people like and why."

"We've run lots of numbers," Feige adds, "and we're very comfortable that we'll be making a good return." Besides, he says, the costs will eventually come down. He expects the set-top boxes to sell for less than $500 in two years' time.

His business model relies heavily on interactive advertising. He predicts that people will want to interact with ads for information-intensive products like cars and pharmaceuticals. But at this point there's no solid evidence that large numbers of people want to interact with TV ads or shop this way. The $4 billion video-shopping and infomercial industry has been successful because tantalising videos of beautiful models create demand. Some people think QVC is entertaining. Besides, the cable industry has never been very successful in attracting regular ads. Less than 20 per cent of its revenue comes from advertisements, whereas the broadcast industry gets nearly 100 per cent of its revenue this way. Feige acknowledges this and admits that no-one knows for sure whether these ad concepts will work. He says simply that he's now in the phase of "understanding the market research".

Time Warner intends to rely on interactive advertising. But will viewers want it?

The last stop on the tour is Fairfax County, Virginia, the county with the highest median household income in the United States. It's a land of lawyers, lobbyists and high-tech workers living in edge cities built from scratch in the 1980s. Peering out from the trees lining the highway are rows of gleaming office towers emblazoned with meaningless corporate names, like Cordant and Visix. "Everything you see has been built in the last five years," the taxi driver told me on my way from Dulles Airport. This is Bell Atlantic's interactive TV test zone.

Since my last visit to the company's "digital factory" in Reston, Virginia, Bell Atlantic's joint video venture with Nynex and Pacific Telesis Group has been busy: its agent, Michael Ovitz, recruited former CBS programming chief Howard Stringer to run the company, now known as Tele-TV. In addition, the company began rolling out its Stargazer service. At the time of this visit, the service was just recently installed into the homes of 50 "friendly users", meaning people from other Bell Atlantic divisions. This first phase of the test was soon to include 1,000 real live paying people as well. The overall point is to gauge whether there is enough demand for new video services to justify Bell Atlantic's five-year plan to build an $11 billion broadband infrastructure.

Like the GTE mainStreet service, this one requires a telephone line. Unlike mainStreet, however, you can still use that line to get phone calls while watching. This service doesn't displace your basic cable service, but adds to it: it requires a second set-top box. Using a technology called ADSL (asymmetrical digital subscriber line), Bell Atlantic channels digital video over the phone lines at speeds of 1.5 Mbits per second, allowing for picture quality about the same as regular cable. The upstream signals race back to Reston, where they trigger videos from nCUBE supercomputers. This technology allows viewers to receive only one program at a time. Starting in 1996, the company plans to supplement the current network with fibre or wireless technology so it can supply multichannel cable service. That's when the battle to kick the traditional cable companies out of homes will take place, according to Bell Atlantic.

My main destination on this trip is the town of McLean. A Washington suburb with quiet, tree-lined streets, McLean is one of the older towns of Fairfax. It's a Tuesday afternoon and I'm accompanied by Bell Atlantic spokesperson Ginger Fisk. We drive up to the colonial home of Kristen Snoots, a 33-year-old single mother who directs a department in Bell Atlantic's consumer services group. When Kristen was growing up in the area, she was allowed to watch only half an hour of TV per day. Usually, she chose *I Love Lucy*. Now, she's similarly strict with the TV allowance for her dark-haired, 5½-year-old daughter Meagan. "I'm a bit of a control freak," Kristen admits.

After chatting in the living room, we walk downstairs into the den to watch the TV rigged up with the Stargazer service. Meagan skips down the steps after us brandishing a tray of Oreos. I sit down as Kristen turns on the tube. The opening Stargazer screen has four major categories: Entertainment, Learning and Lifestyles, Kids Zone and Marketplace, a shopping service that doesn't work yet.

Like all the other interactive TV services, each category has a stylised graphical icon.

The interface reminds me of the sharp, colourful screens of a multimedia reference title. Choose any category and you get a submenu, again with several different choices.

Kristen enters the family's four-digit PIN so we can order some shows, which would range in price from 49 cents for short cartoons to $4.49 for recent feature movies – if the Snoots were paying. Currently, there's a total of nearly 700 videos to choose from. Kristen likes the concept of a PIN and may even set up a separate one for Meagan with a limit on what she can watch and how much she can spend on these videos each month. "I like to control the service," she says. She doesn't want her daughter watching too much TV and wants her to watch only what's appropriate for her age.

She hands me the remote. I choose Entertainment. From the submenu, which also offers four categories, I pick an icon labelled TV Favorites – Talk. The screen lists the first six titles in an alphabetical inventory of 34 highly rated reruns of various Geraldos, Donahues, Sally Jessys and the like. I position the cursor at the bottom of the screen on a forward-arrow icon. When I press the remote's enter button, the next six-video segment of the list appears. Meagan is playing in the other end of the room when Kristen and I spot a listing for a program entitled "Donahue – Addicted to Making Home Sex Videos." "Is this OK?" I ask. Kristen glances over at Meagan, who is not paying attention, then nods her head.

It strikes me that adult programming will do very well on this type of service. With pay-per-view services, you no longer have to worry about running into someone you know at the video store while checking out a copy of *I Like It Like That.* Most of the fare on the Bell Atlantic service is family-oriented. But the sexiest programs are going gangbusters, says Fisk, the PR person. The most popular movie this month, she adds, has been *Belle Epoque,* which is listed under Movies – Drama. For many current releases, you can watch a short preview before buying. Just select the title from the menu and position the cursor on the "preview" icon on the screen. I do that to find out that this French feature is about a soldier who returns from battle only to face the "dilemma" of four voluptuous young women wanting his body.

To cool things down, I hand the remote over to Meagan. Standing in front of the TV, she chooses Kids Zone, which is broken down into Movies, Fun Fair, Let's Explore and Story Place. While munching on her Oreos, she chooses Movies and scrolls down a menu of offerings until she sees "Rainbow Bright and the Star Stealers", a rather interesting cartoon story about a heroic horse with a multicoloured mane. She's already watched the movie four times in the past 10 days. That would cost $1.49 a shot, if the Snoots were paying.

I ask Meagan for her candid assessment of the service. She scrunches up her face in deep thought and then shouts: "Best TV ever!" But Kristen is not sure she'll keep the service when Bell Atlantic starts charging for it – it depends on the price. She says she's not a big TV watcher, averaging only about an hour per day. To start with they don't even have cable, and they rent only about three videos per month. But recently, she says she's "sworn off" the video store, after returning a copy of *Auntie Mame* so late it cost her $44 in late fees. On average, she says she was spending $16 to $18 on late fees per movie. Video-on-demand appeals to her mainly for that reason. Indeed, the video rental industry is known to get about 30 per cent of its revenue from late fees. But still, Kristen is worried that Meagan likes Stargazer a bit *too much.* "Why do I want something that will increase her TV usage?" Kristen says. "That's not an objective of mine."

Pay-per-view adult programming will do well: you don't have to worry about running into someone you know at the video store.

Later in the afternoon, I'm back at the digital factory in Reston, talking with Bell Atlantic business director Kent Libbey about how this service will turn a profit. He expects that most or all of the $15 per month that consumers in the target market currently spend on video rentals and premium channels will shift to the Stargazer service. But he, too, says the business model won't work without interactive advertising. He is negotiating with consumer goods companies and ad agencies to determine whether they will pay extra to "direct their message" to particular viewers "and get a response back." He also expects that the price consumers pay for programming will be a function of how many ads they are willing to accept as interruptions or enhancements to the shows they watch. One possibility is to offer credits for customers to participate in direct marketing. For example, viewers would use their remotes to answer personal questions about life insurance, beer, or cosmetics in return for a free movie.

What if this new advertising model doesn't work? What if people just want to watch their videos and be left alone? If that's the case, Libbey says, "We might have to adjust the size and scope of the offering." In other words, Bell Atlantic might have to scale back its plans.

At the end of my tour, I'm weary, bleary, and burdened with stacks of press kits. All the technology and test markets are blurring together in my mind. It's no longer a mystery to me why everyone in this business has essentially the same vague business model. The net effect of all the alliances that have been written up in *The Wall Street Journal* for the past three years is this: everyone is in cahoots with everyone else. Bell Atlantic is collaborating with Microsoft. Microsoft is in bed with TCI. TCI works with U S West. U S West has an investment in Time Warner. Time Warner is aligned with AT&T. AT&T has done deals with GTE. And so on. They visit each other's trial zones, attend the same conferences, buy the same market research.

Mainly, I was struck by the common threads running through all the tests. All these corporations have the same top-down view of how they can force a change in people's entrenched viewing habits. They all project how revenue will shift from other industries, such as retailing, into their own. They all can demonstrate how their central computers can keep track of every click viewers make. And they all pine for the day when people sell out their communities for the sake of a more convenient way to shop. Meanwhile, none of these companies are doing much about making their systems compatible with each other's. "It's as if we had to create different commercials for each channel," says Judy Black, who chaired a technology committee for the American Association of Advertising Agencies. "That's just not going to fly." And they're not doing much about making them truly two-way. Or about opening up their networks – à la Internet – so consumers can be producers, creating their own programming and distributing their own videos.

By the time I return to my own living room, I am sure that I don't want anything to do with this. I do not want to shop for socks. I don't want a smart set-top box. I do not want a 9-pound ham. I'll just stay the spud I am. I just want to plop down on the sofa, turn on the entertainment, tune out my higher brain functions, and exercise my constitutional right to stare vacantly at the tube, resting assured that interactive television is still little more than an oxymoron. ■ ■ ■

Message 4:
Date: 1.7.95
From: <nicholas@media.mit.edu>
To: <edit@wired.co.uk>
Subject:

Affordable Computing

Andy makes my computer faster. Bill uses more of it. Andy makes my computer yet faster and Bill uses yet more of it. Andy makes more; Bill uses more. What do you and I get when Intel and Microsoft keep adding and taking? Almost nothing. My computer takes forever to start up. Loading my word processor is interminable. Each new release of an application is festooned with gratuitous options and an army of tiny icons the meanings of which I no longer remember.

We've all heard that an application program exposes only the tip of its iceberg. Well, I normally use only the tip! My old Mac 512K went "boing" and was on. I still run Microsoft Word 4.0 (and would run Word 2.0 if I could) because it's fast and simple. The last six years of advances in personal computing have resulted in diminishing returns when one considers the performance we see.

Governments worry about the information-rich versus the information-poor, but most politicians probably don't realise that computers can cost less than bicycles.

According to Moore's law (Gordon Moore is Andy Grove's partner and mentor, and the co-founder of Intel), since I installed Word 4.0 six years ago, my system should now be running 16 times faster – not slower. My lament is: why can't my system run at the same apparent speed it did six years ago and cost 16 times less?

What's going on? Simple. First, the cost of personal computers is held artificially at US$1,500 (give or take $500), because the current market can bear this amount and it provides a suitable profit margin for manufacturers. Second, software is growing far too complex (featuritis), so clean, simple systems are almost extinct. Third, it has been historically difficult for technology companies in the industrialised nations to be in the commodity business and sell 10 million computers at $150 instead of one million at $1,500.

Software and hardware companies can get away with a $1,500 price tag when their primary customers are other businesses. But now that the home is the fastest-growing market, they've got to think about *you* as the customer – and this is an entirely different game. Don't let anyone tell you that a $1,500 price tag is endemic because computers are just plain expensive. Do you need proof that they can be cheap(er)?

Nintendo has released a 20-MHz, 32-bit RISC machine called the Virtual Boy (what an awful name) that includes extraordinary 3-D graphics and stereo sound; two built-in displays with high-res red graphics on a deep black background; and a novel, two-hand game controller. Its US retail price is $180 and it comes with one game cartridge. This product arrives at a time when the yen is below 85 to the dollar. Nintendo is not losing money on the razor to sell the blades.

Why not take that kind of power and build it into a more general-purpose – but stripped-down – machine, with Netscape or Mosaic built in, that everyone can afford? Governments worry about the information-rich versus the information-poor, but most politicians probably don't realise that computers can cost less than bicycles.

Running Moore's law in reverse

In 1976, I had a CRT terminal, the Fox, made by Perkin Elmer (formerly in the business). The Fox had a small footprint, compact display and minimal but adequate keyboard. It cost $200. According to Moore's law, the achievable complexity of an integrated circuit doubles every 18 months. If I correlate complexity with dollars, $200 of 1976 Fox should be worth about $1 million of computer today. So, for one five-thousandth of that amount, why can't I get what I had in the Fox, plus colour and local computing?

The answer is: I can. Manufacturers just need to be pushed into this commodity business so that every school and low-income household can own a computer. This can be achieved without subsidies by trimming the fat from today's PCs and making some bare-bones engines that word process, telecommunicate and provide access to online services. Use a modest colour display – a 13-inch window into the Net is better than no window at all. People are always amazed by the amount of daylight let into a dark room by a small hole (witness the Pantheon in Rome). It's the same on the Net.

Advertiser-supported computing

But even $200 may not be low enough. Or, manufacturers may say: "fine, but give me an order for 10 million, *then* I'll build it for you". OK. Here's an idea for how it could be achieved, getting both the order for 10 million and reducing the price to zero (or lower). Listen carefully, CompuServe.

Today, there are more than 100 million computer screens in the United States (let alone in the rest of the world). Think of every screen as a potential billboard. Let's assume that each one is turned on once a day and, lo and behold, each day a new advertising message appears – the screen saver for the day. That message could be targeted to specific users. No sense showing me an ad for bourbon if I don't drink spirits or an ad for anti-ageing cream if I'm six years old.

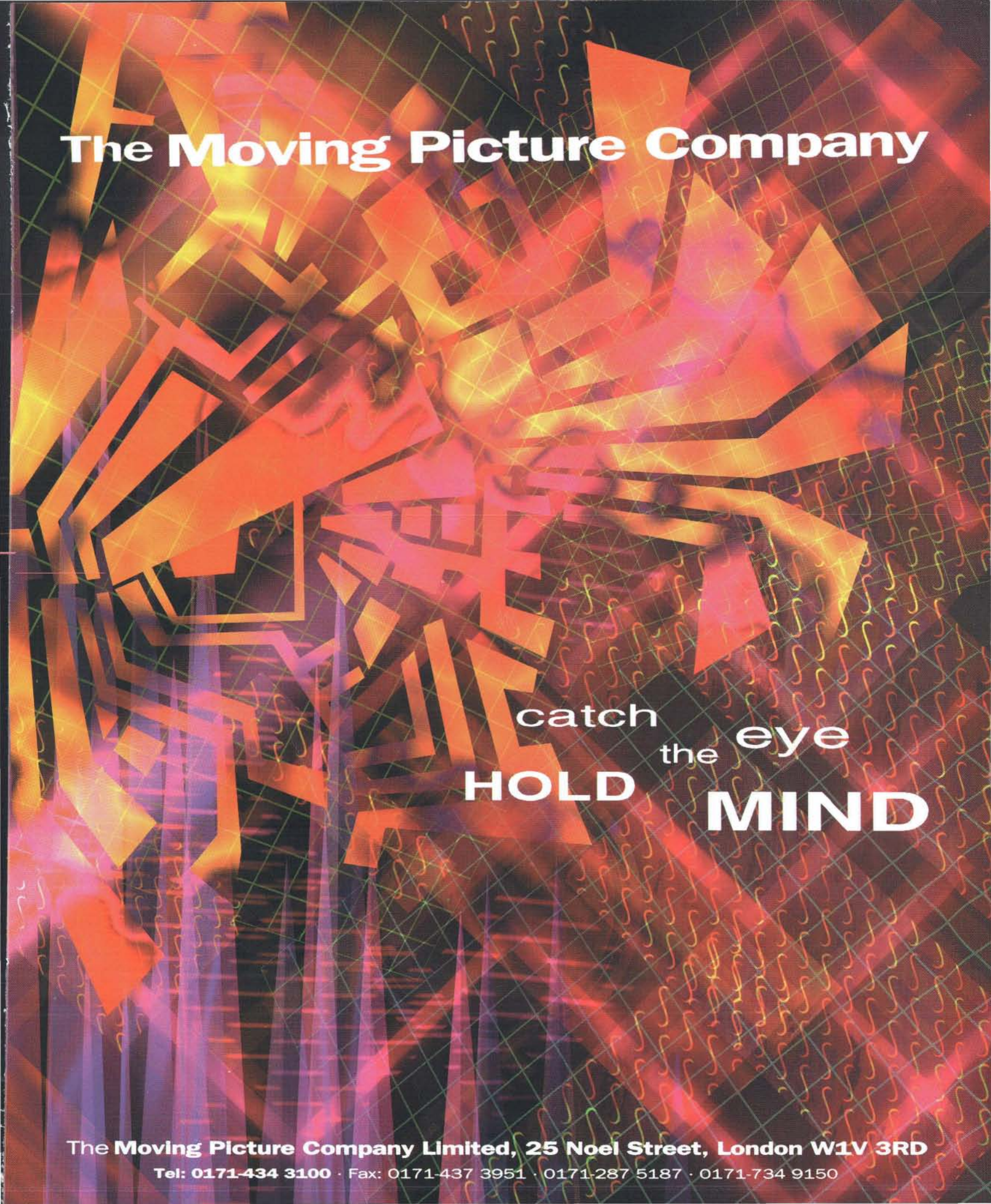
Manufacturer X (the one taking the order for 10 million machines from CompuServe) would probably have to build a small RF receiver so it could load these machines with personalised commercials but without requiring the user to log in or pay for connection time. This could be done, for example, through terrestrial broadcasts, using new forms of satellite paging such as SkyTel.

There are several ways to implement this and more ways to make the business model attractive to vendors (and the computer more or less free). Advertisers would pay to gain access to what turns out to be about 2,000 acres of advertising space (changeable per square inch, per day or per hour). That money could subsidise the cost of the computer and even pay for you to use it.

Will this really work? Yes. Of course, many details need to be resolved. My point is not this specific example, but the need for some creative thinking about PCs. I am no great fan of advertising, but it does represent a quarter-of-a-trillion-dollar industry and there must be a way to use its size to make computing affordable for everybody.

So, step one is to get Andy and Bill to stop scratching each other's backs, and step two is to find new business models to make low-cost PCs available to consumers through the intelligent use of advertising. Come on, boys. ■ ■ ■

BILL ZEMANEK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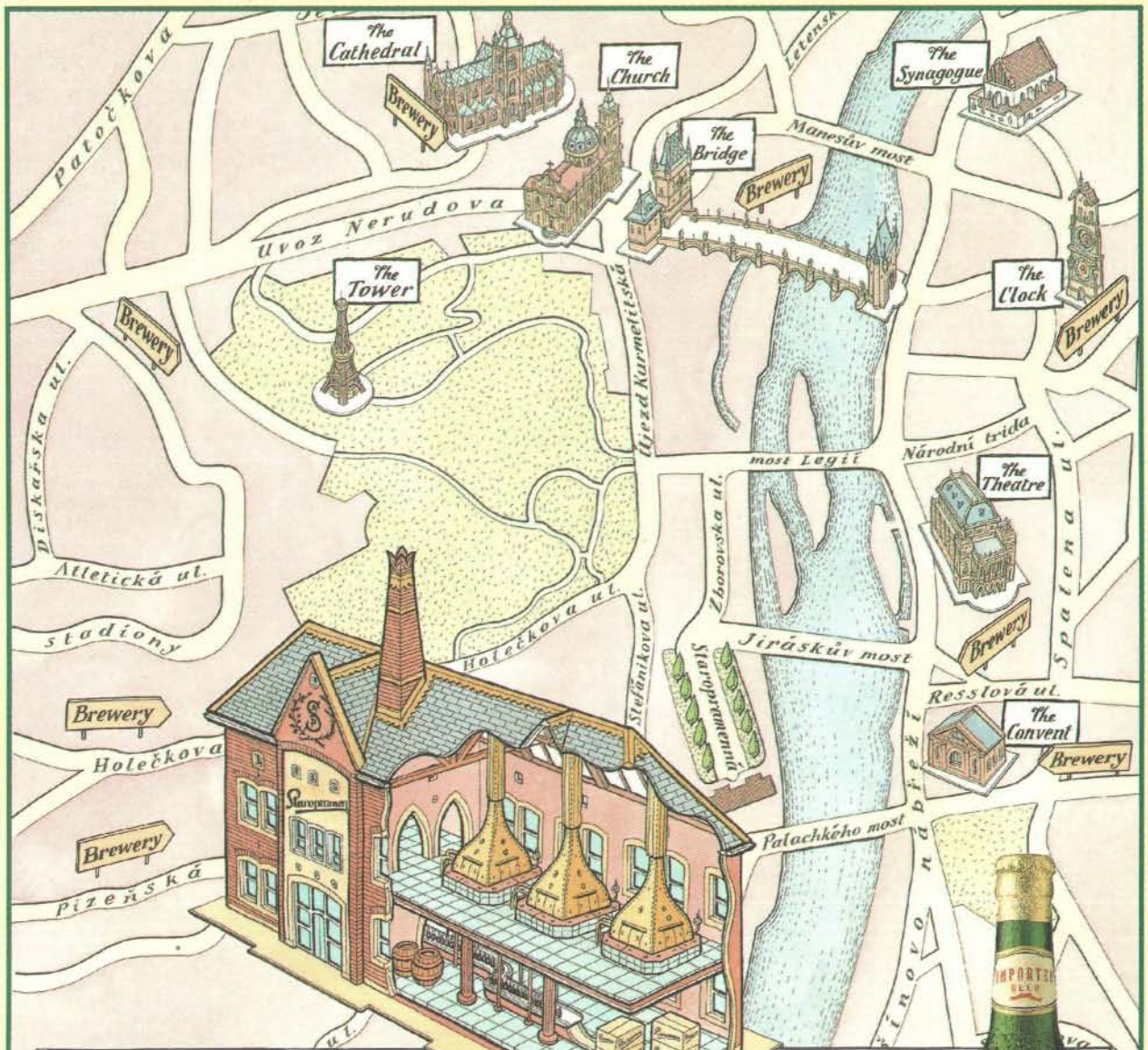

The Staropramen Brewery

What use, the more sensitive citizens of Prague have always asked, is a building that doesn't produce beer?

And nowhere is this passion for great architecture more apparent than in the Old Quarter, where you'll find the Staropramen Brewery. Rising proudly from a tiresome clutter of Baroque cathedrals and Neoclassical churches, this magnificent brick edifice has several windows, a big door and a roof literally covered with tiles. Using the softest water in Europe, it is the sole source of the best loved brew in Prague, a city which drinks more beer than any other in the world. It keeps them waiting 70 thirsty days for Staropramen to mature, but the result is a unique, full-bodied beer which encourages interest in those other architectural jewels in Prague's crown. The buildings where you can drink the stuff.

Staropramen

The Heart of Prague